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VOL. IV. CAA——CIC

*INDOCTI DISCANT, ET AMENT MEMINISSE PERITI.*

*PHILADELPHIA:*

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# ENCYCLOPÆDIA.

## C



C THE third letter, and ſecond conſonant, of the alphabet, is pronounced like *k* before the vowels *a*, *o*, and *u*; and like *s* before *e*, *i*, and *y*. C is formed, according to Scaliger, from the κ of the Greeks, by retrenching the ſtem or upright line; though others derive it from the כ of the Hebrews, which has in effect the ſame form; allowing only for this, that the Hebrews, reading backwards, and the Latins, &c. forwards, each have turned the letter their own way. However, the C not being the ſame as to ſound with the Hebrew *caph*, and it being certain the Romans did not borrow their letters immediately from the Hebrews or other orientals, but from the Greeks, the derivation from the Greek κ is the more probable. Add, that F. Montfaucon, in his Palæographia, gives us ſome forms of the Greek κ, which come very near that of our C; thus, for inſtance, ⊏: and Suidas calls the C the Roman kappa. The ſecond ſound of C reſembles that of the Greek Σ; and many inſtances occur of ancient inſcriptions, in which Σ has the ſame form with our C. All grammarians agree, that the Romans pronounced their Q like our C, and their C like our K. F. Mabillon adds, that Charles the Great was the firſt who wrote his name with a C; whereas all his predeceſſors of the ſame name wrote it with a K: and the ſame difference is obſerved in their coins.

As an abbreviature, C ſtands for Caius, Carolus, Cæſar, *condemno*, &c. and CC for *conſulibus*.

As a numeral, C ſignifies 100, CC 200, &c.

C, in muſic, placed after the cliff, intimates that the muſic is in common time, which is either quick or ſlow, as it is joined with allegro or adagio: if alone, it is uſually adagio. If the C be croſſed or turned, the firſt requires the air to be played quick, and the laſt very quick.

CAABA, or Caabah, properly ſignifies a ſquare ſtone building; but is particularly applied by the Mahometans to the temple of Mecca, built, as they pretend, by Abraham and Iſhmael his ſon.

Before the time of Mahomet, this temple was a place of worſhip for the idolatrous Arabs, and is ſaid to have contained no leſs than 360 different images, equalling in number the days of the Arabian year. They were all deſtroyed by Mahomet, who ſanctified the Caaba, and appointed it to be the chief place of worſhip for all true believers. The temple is in length from north to ſouth about 24 cubits: its breadth from eaſt to weſt is 23; and its height 27. The door, which is on the eaſt ſide, ſtands about four cubits from the ground; the floor being level with the bottom of the door. In the corner next to the door is the *black ſtone*, ſo much celebrated among the Mahometans. On the north ſide of the caaba, within a ſemicircular incloſure 50 cubits long, lies the *white ſtone*, ſaid to be the ſepulchre of Iſhmael, which receives the rain-water from the caaba by a ſpout formerly of wood, but now of gold. The black ſtone, according to the Mahometans, was brought down from heaven by Gabriel at the creation of the world; and originally of a white colour; but contracted the blackneſs that now appears on it, from the guilt of thoſe ſins committed by the ſons of men. It is ſet in ſilver, and fixed in the ſouth-eaſt corner of the caaba, looking towards Baſra, about ſeven ſpans from the ground. This ſtone, upon which there is the figure of a human head, is held in the higheſt eſtimation among the Arabs; all the pilgrims kiſſing it with great devotion, and ſome even calling it the *right hand of God*. Its blackneſs, which is only ſuperficial, is probably owing to the kiſſes and touches of ſo many people. After the Karmatians had taken Mecca, they carried away this precious ſtone, and could by no means be prevailed upon to reſtore it; but finding at laſt that they were unable to prevent the concourſe of pilgrims to Mecca, they ſent it back of their own accord, after having kept it 22 years.

The double roof of the caaba is ſupported within by three octagonal pillars of aloes-wood; between which, on a bar of iron, hang ſome ſilver lamps. The outſide is covered with rich black damaſk, adorned with an embroidered band of gold, which is changed every year, and was formerly ſent by the khalifs, afterwards by the ſultans of Egypt, and is now provided by the Turkiſh emperors. The caaba, at ſome diſtance, is almoſt ſurrounded by a circular incloſure of pillars, joined towards the bottom by a low balluſtrade, and towards the top by bars of ſilver. Juſt without this inner incloſure, on the ſouth, north, and weſt ſides of the caaba, are three buildings, which are the oratories or places where three of the orthodox ſects aſſemble to perform their devotions. Towards the ſouth-eaſt ſtands an edifice which covers the well Zemzem, the treaſury, and the cupola of Al Abbas. Formerly there was another cupola, that went under the name of the *hemicycle*, or *cupola of Judea*: but whether or not any remains of that are now be ſeen is unknown; nor is it eaſy to obtain information in this reſpect, all Chriſtians being denied acceſs to this holy place. At a ſmall diſtance from the caaba, on the eaſt ſide, is the *ſtation* or *place* of Abraham; where is another ſtone much reſpected by the Mahometans; and where they pretend to ſhow the footſteps of the patriarch, telling us he ſtood on it when he built the caaba. Here the fourth ſect of Arabs, *viz.* that of Al Shafei, aſſemble for religious purpoſes.

The ſquare colonnade, or great piazza, that at a conſiderable diſtance incloſes theſe buildings, conſiſts, according to Al Jannabi, of 448 pillars, and has no leſs than 38 gates. Mr Sale compares this piazza to that of the royal exchange at London, but allows it to be much larger. It is covered with ſmall domes or cupolas, from the four corners of which riſe as many minarets or ſteeples, with double galleries, and adorned with gilded ſpires and creſcents after the Turkiſh manner, as are alſo the cupolas which cover the piazza and other buildings. Between the columns of both incloſures hang a great number of lamps, which are conſtantly lighted at night. The firſt foundations of this ſecond incloſure were laid by Omar the ſecond khalif, who built no more than a low wall, to prevent the court of the caaba from being incroached upon by private buildings; but by the liberality of ſucceeding princes, the whole has been raiſed to that ſtate of magnificence in which it appears at preſent.

This temple enjoys the privilege of an aſylum for all ſorts of criminals; but it is moſt remarkable for the pilgrimages made to it by the devout muſſelmans, who pay ſo great a veneration to it, that they believe a ſingle ſight of its ſacred walls, without any particular act of devotion, is as meritorious, in the ſight of God, as the moſt careful diſcharge of one's duty, for the ſpace of a whole year, in any other temple.

CAAMINI, in botany, a name given by the Spaniards and others to the fineſt ſort of Paraguayan tea. It is the leaf of a ſhrub which grows on the mountains of Maracaya, and is uſed in Chili and Peru as the tea is with us. The mountains where this ſhrub grows naturally are far from the inhabited parts of Paraguay; but the people of the place know ſo well the value and uſe of it, that they conſtantly furniſh themſelves with great quantities of it from the ſpot. They uſed to go out on theſe expeditions many thouſands together; leaving their country in the mean time expoſed to the inſults of their enemies, and many of themſelves periſhing by fatigue. To avoid theſe inconveniences, they have of late planted theſe trees about their habitations; but the leaves of theſe cultivated ones have not the fine flavour of thoſe that grow wild. The king of Spain has permitted the Indians of Paraguay to bring to the town of Saintfoy 12,000 arobes of the leaves of this tree every year, but they are not able to procure ſo much of the wild leaves annually: about half the quantity is the utmoſt they bring of this: the other half is made up of the leaves of the trees in their own plantations; and this ſells at a lower price, and is called *pabos*. The arobe is about 25 pound weight; the general price is four piaſtres; and the money is always divided equally among the people of the colony.

CAANA, or Kaana, a town in Upper Egypt, ſeated on the eaſtern banks of the river Nile, from whence they carry corn and pulſe for the ſupply of Mecca in Arabia. E. Long. 32. 23. N. Lat. 24. 30. Here are ſeveral monuments of antiquity yet remaining, adorned with hieroglyphics.

CAB, an Hebrew dry meaſure, being the ſixth part of a ſeah or ſatum, and the 18th part of an ephah. A cab contained $2\frac{5}{6}$ pints of Engliſh corn-meaſure: a quarter cab was the meaſure of dove's dung, or more properly a ſort of chick-peaſe called by this name, was ſold at Samaria, during the ſiege of that city, for five ſhekels.

CABAL, an apt name currently given to the infamous miniſtry of Charles II. compoſed of five perſons, Clifford, Aſhley, Buckingham, Arlington, and Lauderdale; the firſt letters of whoſe names, in this order, furniſhed the appellation by which they were diſtinguiſhed.

CABALIST, in French commerce, a factor or perſon who is concerned in managing the trade of another.

CABALLARIA, in middle-age writers, lands held by the tenure of furniſhing a horſeman, with ſuitable equipage, in time of war, or when the lord had occaſion for him.

CABALLEROS, or Cavalleros, are Spaniſh wools, of which there is a pretty conſiderable trade at Bayonne in France.

CABALLINE, denotes ſomething belonging to horſes; thus caballine aloes is ſo called, from its being chiefly uſed for purging horſes; and common brimſtone is called *ſulphur caballinum* for a like reaſon.

CABALLINUM (anc. geog.), a town of the Ædui in Gallia Celtica; now *Challon ſur Saone*, which ſee.

CABALLINUS (anc. geog.), a very clear fountain of mount Helicon in Bœotia; called *Hippocrene* by the Greeks, becauſe opened by Pegaſus on ſtriking the rock with his hoof, and hence called *Pegaſius*.

CABALLIO, or Cabellio (anc. geog.), a town of the Cavares in Gallia Narbonnenſis, ſituated on the Druentia. One of the Latin colonies, in the Notitiæ called *Civitas Cabellicorum*. Now *Cavaillon* in Provence.

CABBAGE, in botany. See Brassica; and Agriculture, n° 40, and 169. In the Georgical eſſays, we find this plant greatly recommended as an excellent food for cattle, producing much dung, and being an excellent ſubſtitute for hay. The author prefers the Scotch kind, as being moſt durable, and preferable on all other accounts. He alſo recommends autumn-ſowed plants in preference to thoſe ſowed in the ſpring; the former producing a much more weighty crop than the latter. The expence of raiſing an acre of good cabbages he values at 14*l.* 15*s.* and its produce at 34*l.*

*Cabbage-Tree*, or *True Cabbage-Palm*. See Areca.

*Cabbage-bark Tree*. See Geoffræa.

CABBALA, according to the Hebrew ſtyle, has a very diſtinct ſignification from that wherein we underſtand it in our language. The Hebrew cabbala ſignifies tradition; and the Rabbins, who are called *cabbaliſts*, ſtudy principally the combination of particular words, letters, and numbers, and by this means pretend to diſcover what is to come, and to ſee clearly into the ſenſe of many difficult paſſages of ſcripture. There are no ſure principles of this knowledge, but it depends upon ſome particular traditions of the ancients; for which reaſon it is termed *cabbala*.

The cabbaliſts have abundance of names which they call *ſacred*; theſe they make uſe of in invoking of ſpirits, and imagine they receive great light from them.

They

They tell us, that the secrets of the cabbala were discovered to Moses on mount Sinai; and that these have been delivered to them down from father to son, without interruption, and without any use of letters; for to write them down, is what they are by no means permitted to do. This is likewise termed the *oral law*, because it passed from father to son, in order to distinguish it from the written laws.

There is another cabbala, called *artificial*, which consists in searching for abstruse and mysterious significations of a word in Scripture, from whence they borrow certain explanations, by combining the letters which compose it: this cabbala is divided into three kinds, the gematrie, the notaricon, and the temura or themurah. The first whereof consists in taking the letters of a Hebrew word for ciphers or arithmetical numbers, and explaining every word by the arithmetical value of the letters whereof it is composed. The second sort of cabbala, called *notaricon*, consists in taking every particular letter of a word for an entire diction; and the third, called *themura*, i. e. change, consists in making different transpositions or changes of letters, placing one for the other, or one before the other.

Among the Christians, likewise, a certain sort of magic is, by mistake, called *cabbala;* which consists in using improperly certain passages of Scripture for magic operations, or in forming magic characters or figures with stars and talismans.

Some visionaries among the Jews believe, that Jesus Christ wrought his miracles by virtue of the mysteries of the cabbala.

CABBALISTS, the Jewish doctors who profess the study of the cabbala.

In the opinion of these men, there is not a word, letter, or accent in the law, without some mystery in it. The Jews are divided into two general sects: the karaites, who refuse to receive either tradition or the talmud, or any thing but the pure text of scripture; and the rabbinists, or talmudists, who, besides this, receive the traditions of the ancients, and follow the talmud.

The latter are again divided into two other sects; pure rabbinists, who explain the scripture in its natural sense, by grammar, history, and tradition; and cabbalists, who, to discover hidden mystical senses, which they suppose God to have couched therein, make use of the cabbala, and the mystical methods abovementioned.

CABECA, or CABESSE, a name given to the finest silks in the East Indies, as those from 15 to 20 *per cent.* inferior to them are called *barina*. The Indian workmen endeavour to pass them off one with the other; for which reason, the more experienced European merchants take care to open the bales, and to examine all the skaines one after another. The Dutch distinguish two sorts of cabecas; namely, the moor cabeca, and the common cabeca. The former is sold at Amsterdam for about 21¼ schellinghen Flemish, and the other for about 18¼.

*CABECA de Vide*, a small sea-port town of Alentejo in Portugal, with good walls, and a strong castle. W. Long. 6. 43. N. Lat. 39. 0.

CABENDA, a sea-port of Congo in Africa, situated in E. Long. 12. 2. S. Lat. 4. 5.



CABES, or GABES, a town of Africa, in the kingdom of Tunis, seated on a river near the gulph of the same name. E. Long. 10. 55. N. Lat. 33. 40.

CABEZZO, a province of the kingdom of Angola, in Africa; having Oacco on the north, Lubolo on the south, the Coanza on the north-east, and the Reinba on the south-west. It is populous, and well stored with cattle, &c. and hath a mine of iron on a mountain from thence called the *iron mountain*, which yields great quantities of that metal; and this the Portuguese have taught the natives to manufacture. This province is watered by a river called *Rio Longo*, and other small rivulets, lakes, &c. The trees here are vastly large; and they have one sort not unlike our apple-trees, the bark of which being slashed with a knife, yields an odoriferous resin of the colour and consistency of wax, and very medicinal in its nature, only a little too hot for Europeans, unless qualified by some cooling drug.

CABIDOS, or CAVIDOS, a long measure used at Goa, and other places of the East Indies belonging to the Portuguese, to measure stuffs, linens, &c. and equal to ⅘ths of the Paris ell.

CABIN, a room or apartment in a ship where any of the officers usually reside. There are many of these in a large ship; the principal of which is designed for the captain or commander. In ships of the line this chamber is furnished with an open gallery in the ship's stern, as also a little gallery on each quarter. The apartments where the inferior officers or common sailors sleep and mess are usually called BIRTHS; which see.

The bed-places built up for the sailors at the ship's side in merchantmen are also called *cabins*.

CABINDA, the chief port of the kingdom of Angoy in Loango in Africa. It is situated at the mouth of a river of the same name about five leagues north of Cape Palmerino, on the north side of the mouth of the river Zaire. The bay is very commodious for trade, wooding, and watering.

CABINET, the most retired place in the finest part of a building, set apart for writing, studying, or preserving any thing that is precious.

A complete apartment consists of a hall, anti-chamber, chamber, and cabinet, with a gallery on one side. Hence we say, a cabinet of paintings, curiosities, &c.

CABINET, also denotes a piece of joiner's workmanship, being a kind of press or chest, with several doors and drawers.

There are common cabinets of oak or of chesnut, varnished cabinets of China and Japan, cabinets of inlaid work, and some of ebony, or the like scarce and precious woods. Formerly the Dutch and German cabinets were much esteemed in France; but are now quite out of date, as well as the cabinets of ebony which came from Venice.

CABINET is also used in speaking of the more select and secret councils of a prince or administration. Thus we say, the secrets, the intrigues of the cabinet. To avoid the inconveniences of a numerous council, the policy of Italy and practice of France first introduced cabinet councils. King Charles I. is charged with first establishing this usage in England. Besides his privy council, that prince erected a kind of cabinet council, or junto, under the denomination of a council of state; composed of archbishop Laud, the earl of

Strafford, and lord Collington, with the secretaries of state. Yet some pretend to find the substance of a cabinet council of much greater antiquity, and even allowed by parliament, who anciently settled a quorum of persons most confided in, without whose presence no arduous matter was to be determined; giving them power to act without consulting the rest of the council. As long since as the 28th of Henry III. a charter passed in affirmance of the ancient rights of the kingdom; which provided, that four great men, chosen by common consent, who were to be conservators of the kingdom, among other things, should see to the disposing of monies given by parliament, and appropriated to particular uses: and parliaments were to be summoned as they should advise. But even of these four, any two made a quorum; and generally the chief justice of England, and chancellor, were of the number of the conservators. Matth. Par. 28. Hen. III. In the first of Henry VI. the parliament provides, that the quorum for the privy council be six, or four at least; and that in all weighty considerations, the dukes of Bedford and Gloucester, the king's uncles, should be present; which seems to be erecting a cabinet by law.

CABIRI, a term in the theology of the ancient Pagans, signifying great and powerful gods; being a name given to the gods of Samothracia. They were also worshipped in other parts of Greece, as Lemnos and Thebes, where the cabiria were celebrated in honour of them; these gods are said to be, in number, four, viz. Axieros, Axiocersa, Axiocersus, and Casmilus.

CABIRIA, festivals in honour of the Cabiri, celebrated in Thebes and Lemnos, but especially in Samothracia, an island consecrated to the Cabiri. All who were initiated into the mysteries of these gods, were thought to be secured thereby from storms at sea, and all other dangers. The ceremony of initiation was performed by placing the candidate, crowned with olive branches, and girded about the loins with a purple ribband, on a kind of throne, about which the priests, and persons before initiated, danced.

CABLE, a thick, large, strong rope, commonly of hemp, which serves to keep a ship at anchor.

There is no merchant-ship, however weak, but has at least three cables; namely, the chief cable, or cable of the sheet-anchor, a common cable, and a smaller one.

Cable is also said of ropes, which serve to raise heavy loads, by the help of cranes, pullies, and other engines. The name *cable* is usually given to such as have, at least, three inches in circumference; those that are less are only called *ropes*, of different names according to their use.

Every cable, of whatsoever thickness it be, is composed of three strands: every strand of three ropes; and every rope of three twists: the twist is made of more or less threads, according as the cable is to be thicker or thinner.

In the manufacture of cables, after the ropes are made, they use sticks, which they pass first between the ropes of which they make the strands, and afterwards between the strands of which they make the cable, to the end that they may all twist the better, and be more regularly wound together; and also, to prevent them from entwining or entangling, they hang, at the end of each strand and of each rope, a weight of lead or of stone.

The number of threads each cable is composed of is always proportioned to its length and thickness; and it is by this number of threads that its weight and value are ascertained: thus, a cable of three inches circumference, or one inch diameter, ought to consist of 48 ordinary threads, and to weigh 192 pounds; and on this foundation is calculated the following table, very useful for all people engaged in marine commerce, who fit out merchantmen for their own account, or freight them for the account of others.

*A table of the number of threads and weight of cables of different circumferences.*

| Circumf. | Threads. | Weight. |
|---|---|---|
| 3 inches | 48 | 192 pounds. |
| 4 | 77 | 308 |
| 5 | 121 | 484 |
| 6 | 174 | 696 |
| 7 | 238 | 952 |
| 8 | 311 | 1244 |
| 9 | 393 | 1572 |
| 10 | 485 | 1940 |
| 11 | 598 | 2392 |
| 12 | 699 | 2796 |
| 13 | 821 | 3284 |
| 14 | 952 | 3808 |
| 15 | 1093 | 4372 |
| 16 | 1244 | 4976 |
| 17 | 1404 | 5616 |
| 18 | 1574 | 6296 |
| 19 | 1754 | 7016 |
| 20 | 1943 | 7772 |

*Sheet-Anchor* CABLE is the greatest cable belonging to a ship.

*Stream* CABLE, a hawser or rope, something smaller than the bowers, and used to moor the ship in a river, or haven, sheltered from the wind and sea, &c.

*Serve or Plate the* CABLE, is to bind it about with ropes, clouts, &c. to keep it from galling in the hawse.

*To splice a* CABLE, is to make two pieces fast together, by working the several threads of the rope the one into the other.

*Pay more* CABLE, is to let more out of the ship. *Pay cheap the Cable*, is to hand it out apace. *Veer more Cable*, is to let more out, &c.

CABLE's *Length*, a measure of 120 fathoms, or of the usual length of the cable.

CABLED, in heraldry, a term applied to a cross formed of the two ends of a ship's cable; sometimes also to a cross covered over with rounds of rope; more properly called a *cross corded*.

CABLED *Flute*, in architecture, such flutes as are filled up with pieces in the form of a cable.

CABO DE ISTRIA, the capital town of the province of Istria, in the territory of Venice; and the see of a bishop. It is seated on a small island in the gulf of Venice, and is joined to the main land by draw-bridges. E. Long. 14. 22. N. Lat. 45. 49.

CABOCHED, in heraldry, is when the heads of beasts are borne without any part of the neck, full-faced.

CABOLETTO, in commerce, a coin of the republic of Genoa, worth about 3d. sterling.

CABOT (Sebastian), the first discoverer of the continent of America, was the son of John Cabot a Venetian. He was born at Bristol in 1477; and was taught by his father arithmetic, geometry, and cosmography.

Cabot, Cabra. graphy. Before he was 20 years of age he made several voyages. The first of any consequence seems to have been made with his father, who had a commission from Henry VII. for the discovery of a north-west passage to India. They sailed in the spring of 1497; and proceeding to the north-west they discovered land, which for that reason they called *Primavista* or *Newfoundland*. Another smaller island they called *St John*, from its being discovered on the feast of St John Baptist; after which, they sailed along the coast of America as far as Cape Florida, and then returned to England with a good cargo, and three Indians aboard. Stowe and Speed ascribe these discoveries wholly to Sebastian, without mentioning his father. It is probable that Sebastian, after his father's death, made several voyages to these parts, as a map of his discoveries, drawn by himself, was hung up in the privy garden at Whitehall. However, history gives but little account of his life for near 20 years; when he went to Spain, where he was made pilot-major, and intrusted with reviewing all projects for discoveries, which were then very numerous. His great capacity and approved integrity induced many eminent merchants to treat with him about a voyage by the new found straits of Magellan to the Moluccas. He therefore sailed in 1525, first to the Canaries; then to the Cape Verd islands; thence to St Augustine and the island of Patos; when some of his people beginning to be mutinous, and refusing to pass through the straits, he laid aside the design of sailing to the Moluccas; left some of the principal mutineers upon a desert island; and, sailing up the rivers of Plate and Paraguay, discovered, and built forts in, a large tract of fine country, that produced gold, silver, and other rich commodities. He thence dispatched messengers to Spain for a supply of provisions, ammunition, goods for trade, and a recruit of men: but his request not being readily complied with, after staying five years in America, he returned home; where he met with a cold reception, the merchants being displeased at his not having pursued his voyage to the Moluccas, while his treatment of the mutineers had given umbrage at court. Hence he returned to England; and being introduced to the duke of Somerset, then lord protector, a new office was erected for him: he was made governor of the mystery and company of the merchant adventurers for the discovery of regions, dominions, islands, and places unknown; a pension was granted him, by letters patent, of 166l. 13s. 4d. per annum; and he was consulted in all affairs relative to trade. In 1522, by his interest, the court fitted out some ships for the discovery of the northern parts of the world. This produced the first voyage the English made to Russia, and the beginning of that commerce which has ever since been carried on between the two nations. The Russia company was now founded by a charter granted by Philip and Mary: and of this company Sebastian was appointed governor for life. He is said to be the first who took notice of the variation of the needle, and who published a map of the world. The exact time of his death is not known, but he lived to be above 70 years of age.

CABRA, a town of the kingdom of Tombut in Africa. It is a large town, but without walls; and is seated on the river Niger, about 12 miles from Tombut. The houses are built in the shape of bells; and the walls are made with stakes or hurdles, plastered with clay, and covered with reeds after the manner of thatch. This place is very much frequented by negroes who come here by water to trade. The town is very unhealthy, which is probably owing to its low situation. The colour of the inhabitants is black, and their religion a sort of Mahometanism. They have plenty of corn, cattle, milk, and butter; but salt is very scarce. The judge who decides controversies is appointed by the king of Tombut. E. Long. 0. 50. N. Lat. 14. 21.

Cabul, Cabulistan CABUL, or GABOUL, a city of Asia, and capital of the province of Cabulistan. It lies in E. Long. 68. 15. N. Lat. 33. 30. on the frontiers of Great Bukharia, on the south side of the mountains which divide the territories of the Mogul from that part of Great Tartary. It is one of the finest places in that part of the world; large, rich, and very populous. As it is considered as the key of the Great Mogul's dominions on that side, great care is taken to keep its fortifications in repair, and a numerous garrison is maintained for its security. It lies on the road between Samarcand and Lahor; and is much frequented by the Tartars, Persians, and Indians. The Usbec Tartars drive there a great trade in slaves and horses, of which it is said that no fewer are sold than 60,000 annually. The Persians bring black cattle and sheep, which renders provisions very cheap. They have also wine, and plenty of all sorts of eatables. The city stands on a little river which falls into the Indus, and thereby affords a short and speedy passage for all the rich commodities in the country behind it, which, when brought to Cabul, are there exchanged for slaves and horses, and then conveyed by merchants of different countries to all parts of the world. The inhabitants are most of them Indian pagans, though the officers of the Mogul and most of the garrison are Mahometans.

CABULISTAN, a province of Asia, formerly belonging to the Great Mogul; but ceded in 1739 to Kouli Khan, who at that time governed Persia. It is bounded on the north by Bukharia, on the east by Caschmire, on the west by Zabulistan and Candahar, and on the south by Multan. It is 250 miles in length, 240 in breadth, and its chief town is Cabul. This country in general is not very fruitful; but in the vales they have good pasture-lands. The roads are much infested with banditti; which obliges the natives to have guards for the security of travellers. The religion of the Cabulistans is pagan, and their extraordinary time of devotion is the full moon in February, and continues for two days. At this time they are clothed in red, make their offerings, dance to the sound of the trumpet, and make visits to their friends in masquerade dresses. They say, their god Crusman killed a giant, who was his enemy, and that he appeared like a little child; in memory of which, they cause a child to shoot at the figure of a giant. Those of the same tribe make bonefires, and feast together in a jovial manner. The moral part of their religion consists in charity; for which reason they dig wells and build houses for the accommodation of travellers. They have plenty of provisions, mines of iron, myrobolans, aromatic woods, and drugs of many kinds. They carry on a great trade with the neighbouring countries; by which means they are very rich, and are supplied with plenty of all things.

CABURNS, on ſhip-board, are ſmall lines made of ſpun yarn, to bind cables, ſeize tackles, or the like.

CACALIA, in botany; a genus of the polygamia æqualis order, belonging to the ſyngeneſia claſs of plants. The receptacle is naked; the pappus hairy; the calyx cylindrical, oblong, and caliculated, or having a ſmall calyx of very ſhort ſcales only at the baſe.

*Species*. 1. The ſuaveolens, with a herbaceous ſtalk, is a native of North America. It hath a perennial creeping root which ſends out many ſtalks, garniſhed with triangular ſpear-ſhaped leaves ſharply ſawed on their edges, of a pale green on their under ſide, but a deep ſhining green above, placed alternately. The ſtalks riſe to the height of ſeven or eight feet, and are terminated by umbels of white flowers, which are ſucceeded by oblong ſeeds covered with down. It flowers in Auguſt, and the ſeeds ripen in October. The ſtalks decay in autumn, and new ones riſe in the ſpring. This plant multiplies greatly by its ſpreading roots, as alſo by the ſeeds, which are ſpread to a great diſtance by the wind, the down which adheres to them being greatly aſſiſting to their conveyance. The roots which have been caſt out of Chelſea garden, being carried by the tide to a great diſtance, have fixed themſelves to the banks of the river, and increaſed ſo much, that in a few years this ſpecies may probably appear as a native of England. 2. The ficoides is a native of the Cape of Good Hope. It riſes with ſtrong round ſtalks to the height of ſeven or eight feet, woody at bottom, but ſoft and ſucculent upward, ſending out many irregular branches, garniſhed more than half their length with thick, taper, ſucculent leaves, a little compreſſed on two ſides, ending in points, covered with a whitiſh glaucous farina, which comes off when handled. Theſe, when broken, emit a ſtrong odour of turpentine, and are full of a viſcous juice; at the extremity of the branches the flowers are produced in ſmall umbels; they are white, tubulous, and cut into five parts at the top. The leaves of this plant are pickled by the French, who eſteem them much; and in doing this they have a method of preſerving the white farina upon them, which adds greatly to the beauty of the pickle when brought to table. 3. The kleinia, with a compound ſhrubby ſtalk, grows naturally in the Canary iſlands, but has long been cultivated in the Engliſh gardens. It riſes with a thick fleſhy ſtem divided at certain diſtances, as it were, into ſo many joints. Each of theſe diviſions ſwell much larger in the middle than they do at each end; and the ſtalks divide into many irregular branches of the ſame form, which, toward their extremities, are garniſhed with long, narrow, ſpear-ſhaped leaves of a glaucous colour, ſtanding all round the ſtalks without order. As they fall off, they leave a ſcar at the place, which always remains on the branches. The flowers are produced in large cluſters at the extremity of the branches, which are tubulous, and of a faint carnation colour. They appear in Auguſt and September, but continue great part of October, and are not ſucceeded by ſeeds in England. There have been ſtones and foſſils dug up at a very great depth in ſome parts of England having very perfect impreſſions of this plant upon them; from whence Dr Woodward has ſuppoſed the plants were lodged there at the univerſal deluge; and finding the impreſſions of many other plants and animals which are natives of thoſe iſlands, he concludes that the water flowed hither from the ſouth-weſt. This plant has been called the *cabbage-tree*, from the reſemblance which the ſtalk of it has to the cabbage: others have intitled it *carnation-tree*, from the ſhape of the leaves and the colour of the flowers. Beſides theſe, there are ſeven other ſpecies, viz. the alpina, with kidney-ſhaped leaves; the glabra, with ſmooth leaves; the atriplicifolia, with heart-ſhaped ſinuated leaves; the papillaris, with a ſhrubby ſtalk guarded on every ſide with broken rough footſtalks; the ante-euphorbium, with oblong oval leaves; the ſonchifolia, with lyre-ſhaped indented leaves; and the lutea, with leaves divided into five acute parts.



*Culture*. The three ſpecies deſcribed above are very eaſily propagated. The firſt will propagate itſelf, as already mentioned, either by roots or ſeeds. The ſecond is eaſily propagated by cuttings during the ſummer months: Theſe ſhould be cut from the plants and laid to dry a fortnight, that the wound may be healed over before they are planted. Moſt people plunge the pots in which theſe are planted into an hot-bed, to promote their putting out roots; but if planted in June or July, they will root as well in the open air. Even branches broken off by accident have frequently put out roots when fallen on the ground, without any care. Theſe branches may be kept ſix months out of the ground, and will take root if planted. This ſhould have a light ſandy earth, and in winter be placed in an airy glaſs-caſe, where they may enjoy the ſun and air in mild weather, but muſt be protected from froſt. During the winter ſeaſon the plants muſt have but little water; and in ſummer, when they are placed in the open air, it ſhould not be given to them too often, nor in great quantity. The third is alſo propagated by cuttings, and the plants require the ſame culture; but muſt have a dry warm glaſs-caſe in winter, and very little water, being ſubject to rot with wet. In ſummer they muſt be placed in the open air in a warm ſheltered ſituation, and in very dry weather refreſhed moderately with water. With this management the plants will flower annually, and grow to the height of eight or ten feet.

CACAO. See THEOBROMA.

CACCOONS. See FEVILLEA.

CACERES, a town of Spain, in the province of Eſtremadura, is ſeated on the river Saler, and noted for the exceding fine wool which the ſheep bear in the neighbourhood. Between this town and Brocos, there is a wood, where the allies defeated the rear-guard of the duke of Berwick, on the 7th of April 1706. E. Long. 6. 47. N. Lat. 39. 15.

CACHALOT, in itchthyology. See PHYSETER.

CACHAN, or CASHAN, a conſiderable town of Perſia in Irac Agemi, where they carry on an extenſive trade in ſilks, ſilver, and gold brocades, and fine earthern ware. It is ſituated in a vaſt plain, 55 miles from Iſpahan. E. Long. 50. 2. N. Lat. 34. 10.

CACHAO, a province of the kingdom of Tonquin in Aſia, ſituated in the heart of the kingdom, and ſurrounded by the other ſeven. Its ſoil is fertile, and in ſome places mountainous, abounding with variety of trees, and particularly that of varniſh. Moſt of theſe provinces carry on ſome branch of the ſilk manufacture, but this moſt of all. It takes its name from the capital, which is alſo the metropolis of the whole kingdom, though in other reſpects hardly comparable to a Chineſe one of the third rank.

CACHAO, a city of the province of that name, in the kingdom of Tonquin in Aſia, ſituated in E. Long. 105.

105. 31. N. Lat. 22. 10. at about 80 leagues diſtance from the ſea. It is prodigiouſly crowded with people, inſomuch that the ſtreets are hardly paſſable, eſpecially on market days. Theſe vaſt crowds, however, come moſtly from the neighbouring villages; upon which account theſe villages have been allowed their halls in particular parts of the city, where they bring and diſpoſe of their wares. The town itſelf, though the metropolis of the whole Tonquineſe kingdom, hath neither walls nor fortifications. The principal ſtreets are wide and airy, but the reſt of them narrow and ill-paved; and except the palace royal and arſenal, the town hath little elſe worth notice. The houſes are low and mean, moſtly built of wood and clay, and not above one ſtory high. The magazines and warehouſes belonging to foreigners are the only edifices built of brick; and which, though plain, yet, by reaſon of their height and more elegant ſtructure, make a conſiderable ſhow among thoſe rows of wooden huts. From the combuſtibility of its edifices, this city ſuffers frequent and dreadful conflagrations. Theſe ſpread with ſuch ſurpriſing velocity, that ſome thouſands of houſes are often laid in aſhes before the fire can be extinguiſhed. To prevent theſe ſad conſequences, every houſe hath either in its yard or even in its centre, ſome low building of brick, in form of an oven, into which the inhabitants on the firſt alarm convey their moſt valuable goods. Beſides this precaution, which every family takes to ſecure their goods, the government obliges them to keep a ciſtern, or ſome other capacious veſſel, always full of water on the top of their houſe, to be ready on all occaſions of this nature; as likewiſe a long pole and bucket, to throw water from the kennel upon the houſes. If theſe two expedients fail of ſuppreſſing the flames, they immediately cut the ſtraps which faſten the thatch to the walls, and let it fall in and waſte itſelf on the ground. The king's palace ſtands in the centre of the city; and is ſurrounded with a ſtout wall, within whoſe cincture are ſeen a great number of apartments two ſtories high, whoſe fronts and portals have ſomething of the grand taſte. Thoſe of the king and his wives are embelliſhed with variety of carvings and gildings after the Indian manner, and all finely varniſhed. In the outer court are a vaſt number of ſumptuous ſtables for the king's horſes and elephants. The appearance of the inner courts can only be conjectured; for the avenues are not only ſhut to all ſtrangers, but even to the king's ſubjects, except thoſe of the privy council, and the chief miniſters of ſtate: yet we are told, that there are ſtair-caſes by which people may mount up to the top of the walls, which are about 18 or 20 feet high; from whence they may have a diſtant view of the royal apartments, and of the fine parterres and fiſh-ponds that are between the cincture and them. The front wall hath a large gate, well ornamented, which is never opened but when the king goes in and out; but at ſome diſtance from it on each ſide there are two poſterns, at which the courtiers and ſervants may go in and out. This cincture, which is of a vaſt circumference, is faced with brick within and without, and the whole ſtructure is terminated by wide ſpacious gardens; which, though ſtored with great variety of proper ornaments, are deſtitute of the grandeur and elegance obſerved in the palaces of European princes. Beſides this palace, the ruins of one ſtill more magnificent are to be obſerved, and are called *Libatvia*. The circumference is ſaid to have been betwixt ſix and ſeven miles: ſome arches, porticoes, and other ornaments, are ſtill remaining; from which, and ſome of its courts paved with marble, it may be concluded to have been as magnificent a ſtructure as any of the eaſtern parts can ſhow. The arſenal is likwiſe a large and noble building, well ſtored with ammunition and artillery The Engliſh factory is ſituated on the north ſide of the city, fronting the river *Song-koy*. It is a handſome low-built houſe, with a ſpacious dining-room in the centre; and on each ſide are the apartments of the merchants, factors, and ſervants. At each end of the building are ſmaller houſes for other uſes, as ſtore-houſes, kitchen, &c. which form two wings with the ſquare in the middle, and parallel with the river, near the bank of which ſtands a long flag-ſtaff, on which they commonly diſplay the Engliſh colours on Sundays and all remarkable days. Adjoining to it, on the ſouth ſide, is the Daniſh factory, which is neither ſo large nor ſo handſome. On the ſame ſide of the river runs a long dike, whoſe timber and ſtones are ſo firmly faſtened together, that no part of it can be ſtirred without moving the whole. This work was raiſed on thoſe banks to prevent the river, during the time of their vaſt rains, from overflowing the city; and it has hitherto anſwered its end; for though the town ſtands high enough to be in no danger from land-floods, it might yet have been otherwiſe frequently damaged, if not totally laid under water, by the overflowing of that river. Some curious obſervations have been communicated to the royal ſociety concerning differences between the tides of thoſe ſeas and thoſe of Europe, viz. that on the Tonquineſe coaſt ebbs and flows but once in 24 hours; that is, that the tide is riſing during the ſpace of 12 hours, and can be eaſily perceived during two of the moon's quarters, but can hardly be obſerved during the other two. In the ſpring tides, which laſt 14 days, the waters begin to riſe at the riſing of the moon; whereas in the low tides, which continue the ſame number of days, the tide begins not till that planet is got below the horizon. Whilſt it is paſſing through the ſix northern ſigns, the tides are obſerved to vary greatly, to riſe ſometimes very high, and ſometimes to be very low; but when it is once got into the ſouthern part of the zodiac, they are then found to be more even and regular,

CACHECTIC, ſomething partaking of the nature of, or belonging to, a cachexy.

CACHEO, a town of Negroland in Africa, ſeated on the river St Domingo. It is ſubject to the Portugueſe, who have three forts there, and carry on a great trade in wax and ſlaves. W. Long. 14. 55. N. Lat. 12. 0.

CACHEXY, in medicine, a vicious ſtate of the humours and whole habit. See (the Index ſubjoined to) MEDICINE.

CACHRYS, in botany: A genus of the digynia order belonging to the pentandria claſs of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The fruit is ſubovate, angled, and cork or ſpongy rinded.

There are five ſpecies, viz. the trifida, with bipinnated leaves; the ſicula, with double winged leaves; the libanotis, with ſmooth furrowed ſeeds; the linearia, with plain channelled fruit; and the hungarica, with a plain, fungous, channelled ſeed. All theſe are perennial plants, rising pretty high, and bearing large umbels of yellow flowers, and may be propagated by seeds which ought to be sown soon after they are ripe; for if they are kept out of the ground till the next spring, they often miscarry. They must also be sown in a shady border where they are to remain: for the plants, having long top-roots, will not bear transplanting so well as many others. The Hungarians in the neighbourhood of Erlaw, and those who border on Transylvania, Servia, &c. eat the root of the fifth species in a scarcity of corn for want of other bread.

CACHUNDE, the name of a medicine, highly celebrated among the Chinese and Indians, and made of several aromatic ingredients, the perfumes, medicinal earth, and precious stones: they make the whole into a stiff paste, and form out of it several figures according to their fancy, which are dried for use: these are principally used in the East Indies, but are sometimes brought over to Portugal. In China, the principal persons usually carry a small piece in their mouths, which is a continued cordial, and gives their breath a very sweet smell. It is a highly valuable medicine also, in all nervous complaints; and is esteemed a prolonger of life, and a provocative to venery, the two great intentions of most of the medicines in use in the East.

CACOCHYLIA, or CACOCHYMIA, a vicious state of the vital humours, especially of the mass of blood; arising either from a disorder of the secretions or excecretions, or from external contagion. The word is Greek, compound of κακος *ill*, and χυμος *juice*.

CACOPHONIA, in grammar and rhetoric, the meeting of two letters, or syllables, which yield an uncouth and disagreeable sound. The word is compounded of κακος *evil*, and φωνη, *voice*.

CACOPHONIA, in medicine, denotes a voice or deprivation of the voice or speech; of which there are two species, *aphonia* and *dysphonia*.

CACTUS, in botany: A genus of the monogynia order, belonging to the icosandria class of plants; and in the natural method ranking under the 13th order, *Succulentæ*. The calyx is monophyllous; superior, or above the receptacle of the fruit imbricated; the corolla polypetalous; the fruit an unilocular, polyspermous berry. To this genus Linnæus has added the cereus and opuntia. There are 24 species, all natives of the West Indies and Mexico.

The cacti are plants of a singular structure, but especially the larger kinds of them; which appear like a large, fleshy, green melon, with deep ribs, set all over with strong sharp thorns; and, when the plants are cut through the middle, their inside is a soft, pale-green, fleshy substance, very full of moisture. The fruit of all the species is frequently eaten by the inhabitants of the West Indies. The fruits are about three quarters of an inch in length, of a taper form, drawing to a point at the bottom toward the plant, but blunt at the top where the empalement of the flower was situated. The taste is agreeably acid, which in a hot country must render the fruit more grateful.

The cochineal animals are supported on a species called *cactus cochenillifer*.—The flower of the cactus grandiflora (one of the creeping cereuses) is said to be as grand and beautiful as any in the vegetable system: It begins to open in the evening about seven o'clock, is in perfection about eleven, and fades about four in the morning: so that the same flower only continues in perfection about six hours. The calyx when expanded is about a foot in diameter, of a splendid yellow within, and a dark brown without; the petals are many, and of a pure white; and the great number of recurved stamina, surrounding the style in the centre of the flower, make a grand appearance, to which may be added the fine scent, which perfumes the air to a considerable distance. It flowers in July.



CACUS, in fabulous history, an Italian shepherd, upon mount Aventine. As Hercules was driving home the herd of king Geryon whom he had slain, Cacus robbed him of some of his oxen, which he drew backward into his den lest they should be discovered. Hercules at last finding them out by their lowing, or the robbery being discovered to him, killed Cacus with his club. He was Vulcan's son, of prodigious bulk, and half man half satyr.

CADAN, a town of Bohemia, in the circle of Zats, seated on the northern bank of the river Egra, in E. Long. 13. 34. N. Lat. 50. 20.

CADARI, or KADARI, a sect of Mahometans, who assert free-will; attribute the actions of men to men alone, not to any secret power determining the will; and deny all absoute decrees, and predestination. The author of this sect was Mabed ben Kaled Al Gihoni, who suffered martyrdom for it. The word comes from the Arabic, קדר, *cadara, power*. Ben Aun calls the Cadarians the Magi, or Manichees of the Mussulmen.

CADE, a cag, cask, or barrel. A cade of herrings is a vessel containing the quantity of 500 red herrings, or 1000 sprats.

*CADE-Lamb*, a young lamb weaned, and brought up by hand, in a house; called *pet-lamb*.

*CADE-Oil*, in the *Materia Medica*, a name given to an oil much in use in some parts of France and Germany. The physicians call it *oleum cadæ*, or *oleum de cada*. This is supposed by some to be the the pissełæum of the ancients, but improperly; it is made of the fruit of the oxycedrus, which is called by the people of these places *cada*.

*CADE-Worm*, in zoology, the maggot or worm of a fly called *phryganea*. It is used as a bait in angling. See PHRYGANEA.

CADEA, or THE LEAGUE OF THE HOUSE OF GOD, is one of those that compose the republic of the Grisons, and the most powerful and extensive of them all. It contains the bishopric of Coire, the great valley of Engadine, and that of Bragail or Pregal. Of the 11 great, or 21 small communities, there are but two that speak the German language; that of the rest is called the *Rhetic*, and is a dialect of the Italian. The Protestant religion is most prevalent in this league, which has been allied to the Swiss cantons ever since the year 1498. Coire is the capital town.

CADENAC, a town of France in Querci, on the confines of Rouergue, seated on the river Lot, in E. Long. 2. 12 N. Lat. 44. 36.

CADENCE, or REPOSE, in music, (from the Latin *cadere* to *fall* or *descend*); the termination of an harmonical phrase on a repose, or on a perfect chord. See MUSIC, art. 73—76, and 132—137.

CADENCE, in reading, is a falling of the voice below the key-note at the close of every period. In reading, whether prose or verse, a certain tone is assumed which is called the *key-note*; and in this tone the bulk of the words

words are founded; but this note is generally lowered towards the close of every sentence.

Cadence, in the manage, an equal measure or proportion, observed by a horse in all his motions; so that his times have an equal regard to one another, the one does not embrace or take in more ground than the other, and the horse observes his ground regularly.

CADENE, one of the sorts of carpets which the Europeans import from the Levant. They are the worst sort of all, and are sold by the piece from one to two piastres per carpet.

CADENET, a town of France in Provence, and in the Viguirie of Apt. E. Long. 5. 30. N. Lat. 43. 40.

CADES, or Kadesh, (anc. geog.) a town in the Wilderness of Zin, in Arabia Petræa; the first encampment of the Israelites, after their departure from Eziongeber; and from which the Wilderness of Zin was called Cades; the burial-place, of Miriam, with the rock and water of Meribah in it. Another *Cades* a town of the tribe of Judah, Joshua xv. 23. *Cadesbarnea*, called also *Cades*.

CADESBARNEA, (anc. geog.) a town of the Wilderness of Paran, on the confines of Canaan, from which the spies were sent out; sometimes simply called *Cades*, but distinct from the Cades in the Wilderness of Zin.

CADET, the younger son of a family, is a term naturalized in our language from the French. At Paris, among the citizens, the cadets have an equal patrimony with the rest. At Caux in Normandy, the custom, as in England, is to leave all to the eldest, except a small portion to the cadets. In Spain, it is usual for one of the cadets in great families to take the mother's name.

Cadet is also a military term denoting a young gentleman who chooses to carry arms in a marching regiment as a private man. His views are, to acquire some knowledge in the art of war, and to obtain a commission in the army. Cadet differs from volunteer, as the former takes pay, whereas the latter serves without pay.

CADI, or Cadhi, a judge of the civil affairs in the Turkish empire. It is generally taken for the judge of a town; judges of provinces being distinguished by the appellation of *moulas*.

We find numerous complaints of the avarice, iniquity, and extortion, of the Turkish cadis; all justice is here venal; the people bribe the cadis, the cadis bribe the moulas, the moulas the cadileschers, and the cadileschers the mufti. Each cadi has his serjeants, who are to summon persons to appear and answer complaints. If the party summoned fails to appear at the hour appointed, sentence is passed in favour of his adversary. It is usually vain to appeal from the sentences of the cadi, since the affair is never heard anew, but judgment is passed on the case as stated by the cadi. But the cadis are often cashiered and punished for crying injustice with the bastinado and mulcts; the law, however, does not allow them to be put to death. Constantinople has had cadis ever since the year 1390, when Bajazet I. obliged John Paleologus, Emperor of the Greeks, to receive cadis into the city to judge all controversies happening between the Greeks and the Turks settled there. In some countries of Africa, the cadis are also judges of religious matters. Among the Moors, cadis is the denomination of their higher order of priests or doctors, answering to the rabbins among the Jews.



CADIACI, the Turkish name of Chalcedon. See Chalcedon.

CADILESCHER, a capital officer of justice among the Turks, answering to a chief justice among us.

It is said, that this authoriry was originally confined to the soldiery; but that, at present, it extends itself to the determination of all kinds of law-suits; yet is nevertheless subject to appeals.

There are but three cadileschers in all the grand signior's territories: the first is that of Europe; the second, of Natolia; and the third resides at Grand Cairo. This last is the most considerable: they have their seats in the divan next to the grand vizir.

CADILLAC, a town of France in Guienne, and in Bazadois, near the river Garonne, with a handsome castle, situated in W. Long. 0. 15. N. Lat. 44. 37.

CADIZ, a city and port town of Andalusia in Spain, situated on the island of Leon, opposite to Port St Mary on the continent, about 60 miles south-west of Seville, and 40 north-west of Gibraltar. W. Long. 6. 40. N. Lat. 36. 30.

It occupies the whole surface of the western extremity of the island, which is composed of two large circular parts, joined together by a very narrow bank of sand, forming altogether the figure of a chain-shot. At the south-east end, the ancient bridge of Suaco, thrown over a deep channel or river, affords a communication between the island and the continent; a strong line of works defends the city from all approaches along the isthmus; and, to render them still more difficult, all the gardens and little villas on the beach were in 1762 cleared away, and a dreary sandy glacis left in their room, so that now there is scarce a tree on the whole island.

Except the *Calle Ancha*, all the streets are narrow. ill-paved, and insufferably stinking. They are all drawn in straight lines, and most of them intersect each other at right angles. The swarms of rats that in the nights run about the streets are innumerable; whole droves of them pass and repass continually, and these their midnight revels are extremely troublesome to such as walk late. The houses are lofty, with each a vestibule, which being left open till night, serve passengers to retire to; this custom, which prevails throughout Spain, renders these places exceedingly offensive. In the middle of the house is a court like a deep well, under which is generally a cistern, the breeding-place of gnats and musquitos; the ground floors are warehouses, the first stories compting-houses or kitchen, and the principal apartment up two pair of stairs. The roofs are flat, covered with an impenetrable cement, and few are without a *mirador* or turret for the purpose of commanding a view of the sea. Round the parapet-wall at top are placed rows of square pillars, meant either for ornament according to some traditional mode of decoration, or to fix awnings to, that such as sit there for the benefit of the sea-breeze may be sheltered from the rays of the sun; but the most common use made of them, is to fasten ropes for drying linen upon. High above all these pinnacles, which give Cadiz a most singular appearance, stands the

the tower of ſignals. Here flags are hung out on the firſt ſight of a ſail, marking the ſize of the ſhip, the nation it belongs to, and, if a Spaniſh Indiaman, the port of the Indies it comes from. The ſhips are acquainted with the proper ſignals to be made, and theſe are repeated by the watchmen of the tower: as painted liſts are in every houſe, perſons concerned in commerce ſoon learn the marks.

The city is divided into twenty-four quarters, under the inſpection of as many commiſſioners of police; and its population is reckoned at one hundred and forty thouſand inhabitants, of which twelve thouſand are French, and at leaſt as many more Italians. The ſquare of Saint Antonio is large, and tolerably handſome, and there are a few ſmaller openings of no great note. The public walk, or Alameda, is pleaſant in the evening: it is fenced off the coach-road by a marble rail. The ſea air prevents the trees from thriving, and deſtroys all hopes of future ſhade.

From the Alameda, continuing your walk weſtwards, you come to the Campoſanto, a large eſplanade, the only airing-place for coaches; it turns round moſt part of the weſt and ſouth ſides of the iſland, but the buildings are ſtraggling and ugly; the only edifice of any ſhow is the new orphan-houſe; oppoſite to it is the fortreſs of St Sebaſtian, built on a neck of land running out into the ſea. The round tower at the extremity is ſuppoſed to have ſaved the city, in the great earthquake of 1755, from being ſwept away by the fury of the waves. The building proved ſufficiently ſolid to withſtand the ſhock, and break the immenſe volume of water that threatened deſtruction to the whole iſland. In the narrow part of the iſthmus the ſurge beat over with amazing impetuoſity, and bore down all before it; among the reſt the grandſon of the famous tragic-poet Racine, who ſtrove in vain to eſcape by urging his horſe to the utmoſt of his ſpeed. On St Sebaſtian's feaſt, a kind of wake or fair is held in the fort; an aſtoniſhing number of people then paſſing and repaſſing, on a ſtring of wooden bridges laid from rock to rock, makes a very lively moving picture.

From hence to the wooden circus where they exhibit the bull-feaſts, you keep turning to the left cloſe above the ſea, which on all this ſide daſhes over large ledges of rock; the ſhore ſeems here abſolutely inacceſſible. On this ſhore ſtands the cathedral, a work of great expence, but carried on with ſo little vigour, that it is difficult to gueſs at the term of years it will require to bring it to perfection. The vaults are executed with great ſolidity. The arches, that ſpring from the cluſtered pilaſters to ſupport the roof of the church, are very bold; the minute ſculpture beſtowed upon them ſeems ſuperfluous, as all the effect will be loſt from their great height, and from the ſhade that will be thrown upon them by the filling up of the interſtices. From the ſea, the preſent top of the church reſembles the carcaſe of ſome huge monſter caſt upon its ſide, rearing its gigantic blanched ribs high above the buildings of the city. The outward caſings are to be of white marble, the bars of the windows of bronze.

Next, croſſing before the land-gate and barracks, a ſuperb edifice for ſtrength, convenience, and cleanlineſs, you come down to the ramparts that defend the city on the ſide of the bay. If the proſpect to the ocean is ſolemn, that towards the main land is animated in the higheſt degree; the men of war ride in the eaſtern boſom of the bay; lower down the merchantmen are ſpread far and near; and cloſe to the town an incredible number of barks; of various ſhapes and ſizes, cover the ſurface of the water, ſome moored and ſome in motion, carrying goods to and fro. The oppoſite ſhore of Spain is ſtudded with white houſes, and enlivened by the towns of St Mary's, Port-real, and others, behind which, eaſtward, on a ridge of hills, ſtands Medina Sidonia, and further back riſe the mountains of Granada. Weſtward, Rota cloſes the horizon, near which was anciently the iſland and city of Tarteſſus, now covered by the ſea, but at low-water ſome part of the ruins are ſtill to be diſcerned. In a large baſtion, jutting out into the bay, they have built the cuſtom-houſe, the firſt ſtory of which is level with the walk upon the walls. When it was reſolved to erect a building ſo neceſſary to this great emporium of trade, the marquis di Squillace gave orders that no expence ſhould be ſpared, and the moſt intelligent architects employed, in order to erect a monument, which by its taſte and magnificence might exite the admiration of poſterity: the reſult of theſe precautions proved a piece of vile architecture, compoſed of the worſt of materials.



The ſtir here is prodigious during the laſt months of the ſtay of the flota. The packers poſſeſs the art of preſſing goods in great perfection; but, as they pay the freight according to the cubic palms of each bale, they are apt to ſqueeze down the cloths and linens ſo very cloſe and hard, as ſometimes to render them unfit for uſe. The exportation of French luxuries in dreſs is enormous; Lyons furniſhes moſt of them; England ſends out bale goods; Brittany and the north, linens. Every commercial nation has a conſul reſident at Cadiz; thoſe of England and France are the only ones not allowed to have any concern in trade.

In 1596, Cadiz was taken, pillaged, and burnt by the Engliſh; but in 1702 it was attempted, in conjunction with the Dutch, without ſucceſs.

CADIZADELITES, a ſect of Mahometans very like the ancient ſtoics. They ſhun feaſts and diverſions, and affect an extraordinary gravity in all their actions; they are continually talking of God, and ſome of them make a jumble of Chriſtianity and Mahometaniſm; they drink wine, even in the faſt of the ramazan; they love and protect the Chriſtians; they believe that Mahomet is the Holy Ghoſt, practiſe circumciſion, and juſtify it by the example of Jeſus Chriſt.

CADMEAN LETTERS, the ancient Greek or Ionic characters, ſuch as they were firſt brought by Cadmus from Phœnicia; whence Herodotus alſo calls them *Phœnician letters.*——According to ſome writers, Cadmus was not the inventor, nor even importer of the Greek letters, but only the modeller and reformer thereof; and it was hence they acquired the appellation *Cadmean* or *Phœnician letters;* whereas before that time they had been called *Pelaſgian letters.*

CADMIA. See CALAMINE.

CADMUS, in fabulous hiſtory, king of Thebes, the ſon of Agenor king of Phœnicia, and the brother of Phœnix, Cilix, and Europa. He carried into Greece the 16 ſimple letters of the Greek alphabet; and there built Thebes, in the Bœotia. The poet ſay, that he left his native country in search of his sister Europa, whom Jupiter had carried away in the form of a bull; and that, inquiring of the Delphic oracle for a settlement, he was answered, that he should follow the direction of a cow, and build a city where she lay down. Having arrived among the Phocenses, he was met by a cow, who conducted him through Bœotia to the place where Thebes was afterwards built: but as he was about to sacrifice his guide to Pallas, he sent two of his company to the fountain Dirce for water; when they being devoured by a serpent or dragon, he slew the monster, and afterwards, by the advice of Pallas, sowed his teeth, when there sprung up a number of armed soldiers, who prepared to revenge the death of the serpent; but on his casting a stone among these upstart warriors, they turned their weapons against each other with such animosity, that only five survived the combat, and these assisted Cadmus in founding his new city. Afterwards, to recompence his labours, the gods gave him Harmonia, or Hermione, the daughter of Mars and Venus; and honoured his nuptials with presents and peculiar marks of favour. But at length resigning Thebes to Pentheus, Cadmus and Hermione went to govern the Ecclellenses: when grown old, they were transformed into serpents; or, as others say, sent to the Elysian fields, in a chariot drawn by serpents. See THEBES.

CADMUS of Miletum, a celebrated Greek historian, was, according to Pliny, the first of the Greeks who wrote history in prose. He flourished about 550 before Christ.

CADORE, or PIEVE DE CADORE, a town of Italy, in the territory of Venice, and capital of a district called *Cadorino;* famous for the birth of Titian the painter. E. Long. 13. 45. N. Lat. 46. 25.

CADORINO, a province of Italy, in the territory of Venice; bounded on the east by Friuli Proper, on the south and west by the Bellunese, and by the bishopric of Brixen on the north. It is a very mountainous country, but pretty populous. The only town is Pieve de Cadore.

CADRITES, a sort of Mahometan friars, who once a-week spend a great part of the night in turning round, holding each others hand, and repeating incessantly the word *hai,* which signifies *living,* and is one of the attributes of God; during which one of them plays on a flute. They never cut their hair, nor cover their heads; and always go barefooted: they have liberty to quit their convent when they please, and to marry.

CADSAND, an island on the coast of Dutch Flanders, situated at the mouth of the Scheld, whereby the Dutch command the navigation of that river.

CADUCEUS, in antiquity, Mercury's rod or sceptre, being a wand entwisted by two serpents borne by that deity as the ensign of his quality and office, given him according to the fable by Apollo, for his seven-stringed harp. Wonderful properties are ascribed to this rod by the poets; as laying men asleep, raising the dead, &c.

It was also used by the ancients as a symbol of peace and concord: the Romans sent the Carthaginians a javelin and a caduceus, offering them their choice either of war or peace. Among that people, those who denounced war were called *feciales;* and those who went to demand peace, *caduceatores,* because they bore a caduceus in their hand.



The caduceus found on medals is a common symbol, signifying good conduct, peace, and prosperity. The rod expresses power, the two serpents prudence, and the two wings diligence.

CADUCI, (from *cado* to "fall"); the name of a class in Linnæus's *calycina,* consisting of plants whose calyx is a simple perianthium, supporting a single flower or fructification, and falling off either before or with the petals. It stands opposed to the *classes persistentes* in the same method, and is exemplified in mustard and ranunculus.

CADURCI, CADURCUM, *Cadurcus,* and *Cadurx,* (anc. geog.), a town of the Cadurci, a people of Aquitania; situated between the rivers Oldus, running from the north, and the Tarnis from the south, and falling into the Garumna: now *Cahors,* capital of the territory of the Querci, in Guienne. A part of the Cadurci to the south next the Tarnis, were called *Eleutheri.*

CADUS, in antiquity, a wine vessel of a certain capacity, containing 80 amphoræ or firkins; each of which, according to the best accounts, held nine gallons.

CADUSII, (anc. geog.) a people of Media Atropatene, situated to the west in the mountains, and reaching to the Caspian sea; between whom and the Medes, perpetual war and enmity continued down to the time of Cyrus.

CÆCILIA, in zoology, a genus of serpents belonging to the amphibia class. The cæcilia has no scales; it is smooth, and moves by means of lateral rugæ or prickles. The upper lip is prominent, and furnished with two tentacula. It has no tail. There are but two species of this serpent, *viz.* 1. The tentaculata has 135 rugæ. It is about a foot long, and an inch in circumference, preserving an uniform cylindrical shape from the one end to the other. The teeth are very small. It has such a resemblance to an eel, that it may easily be mistaken for one; but as it has neither fins nor gills, it cannot be classed with the fishes. It is a native of America, and its bite is not poisonous. 2. The glutinosa, has 340 rugæ or prickles above, and 10 below, the anus. It is of a brownish colour, with a white line on the side, and is a native of the Indies.

CÆCUM, or COECUM, the blind gut. See ANATOMY, Nº 93.

CÆLIUM, (anc. geog.) an inland town of Peucetia, a division of Apulia, a place four or five miles above Barium or Bari; and which still retains that name.

CÆLIUS MONS, (Itinerary); a town of Vindelicia, on the right or west side of the Ilargus. Now *Kelmuntz,* a small town of Suabia, on the Iller.

CÆLIUS MONS at Rome. See COELIUS.

CÆLIUS, (Aurelianus) an ancient physician, and the only one of the sect of the methodists of whom we have any remains. He was of Sicca, a town of Numidia; but in what age he lived, cannot be determined: it is probable, however, that he lived before Galen; since, though he carefully mentions all the physicians before him, he takes no notice of Galen. He had read over very diligently the ancient physi-



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cians of all sects; and we are indebted to him for the knowledge of many dogmas which are not to be found but in his books *de celeribus et tardis passionibus*. He wrote, as he himself tells us, several other works; but they are all perished.

CAEN, an handsome and considerable town of France, capital of Lower Normandy, with a celebrated university, and an academy of literature. It contains 60 streets and 12 parishes. It has a castle with four towers, which were built by the English. The town-house is a large building with four great towers. The royal square is the handsomest in all Normandy, and has fine houses on three sides of it; and in the middle is the statue of Louis XIV. in a Roman habit, standing on a marble pedestal, and surrounded with an iron ballustrade. It is seated in a pleasant country on the river Orne, about eight miles from the sea. William the conqueror was buried here, in the abbey of St Stephen, which he founded. W. Long. 0. 27. N. Lat. 49. 11.

CÆRE, (anc. geog.) a town of Etruria, the royal residence of Mezentius. Its ancient name was *Argyllæ*. In Strabo's time not the least vestige of it remained, except the baths called *cæretana*. From this town the Roman censor's tables were called *cærites tabulæ*. In these were entered the names of such as for some misdemeanor forfeited their right of suffrage, or were degraded from a higher to a less honourable tribe. For the people of Cære hospitably receiving those Romans who, after the taking of Rome by the Gauls, fled with their gods and the sacred fire of Vesta, were, on the Romans recovering themselves from this disaster, honoured with the privilege of the city, but without a right of voting.

CÆRITES TABULÆ. See the preceding article.

CAERFILLY, a town of Glamorganshire in South Wales, seated between the rivers Taff and Rumney, in a moorish ground, among the hills. It is thought the walls, now in ruins, were built by the Romans; there being often Roman coins dug up there. W. Long. 3. 12. N. Lat. 51. 25.

CAERLEON, a town of Monmouthshire in England, and a place of great antiquity. It was a Roman town, as is evident from the many Roman antiquities found here. It is commodiously situated on the river Usk, over which there is a large wooden bridge. The houses are generally built of stone, and there are the ruins of a castle still to be seen. W. Long. 3. 0. N. Lat. 51. 40.

CAERMARTHEN-SHIRE, a county of Wales, bounded on the north by Severn sea or St George's Channel, Cardiganshire on the south, the shires of Brecknock and Glamorgan on the east, and Pembrokeshire on the west. Its greatest length is between 30 and 40 miles, and its breadth upwards of 20. The air is wholesome, and the soil less rocky and mountainous than most other parts of Wales, and consequently is proportionably more fertile both in corn and pasture. It has also plenty of wood, and is well supplied with coal and limestone. The most considerable rivers are the Towy, the Cothy, and the Tave: of which the first abounds with excellent salmon. The principal towns are Caermarthen the capital. Kidwely, Lanimdovery, &c. This county abounds with ancient forts, camps, and tumuli or barrows. Near to Caermarthen towards the east may be seen the ruins of Kastelk Karrey, which was situated on a steep and inaccessible rock; and also several vast caverns, supposed to have been copper-mines of the Romans. Near this spot is a fountain which ebbs and flows twice in 24 hours like the sea.



CAERMARTHEN, a town of Wales, and capital of the county of that name. It is situated on the river Fowey, over which it has a fine stone-bridge. It is of great antiquity, being the Maridunum of Ptolemy. It is a populous, thriving, and polite place, many of the neighbouring gentry residing there in the winter. It is a corporation and county of itself, with power to make by-laws. Here were held the courts of chancery and exchequer for South Wales, till the whole was united to England in the reign of Henry VIII. Here was born the famous conjurer Merlin; and near the town is a wood called *Merlin's grove*, where he is said to have often retired for contemplation. Many of his pretended prophecies are still preserved in the country. The town gives the title of *marquis* to his grace the duke of Leeds. It sends one member to parliament, and the county another.

CAERNARVON-SHIRE, a county of Wales, bounded on the north and west by the sea, on the south by Merionethshire, and on the east it is divided from Denbighshire by the river Conway. It is about 40 miles in length, and 20 in breadth; and sends one member to parliament for the shire, and another for the borough of Caernarvon. The air is very piercing; owing partly to the snow that lies seven or eight months of the year upon some of the mountains, which are so high that they are called the *British Alps;* and partly to the great number of lakes, which are said not to be fewer than 50 or 60. The soil in the valleys on the side next Ireland is pretty fertile, especially in barley; great numbers of black cattle, sheep, and goats, are fed on the mountains; and the sea, lakes, and rivers, abound with variety of fish. The highest mountains in the county are those called *Snowdon hills*, and *Pen-maen-mawr*, which last hangs over the sea. There is a road cut out of the rock on the side next the sea, guarded by a wall running along the edge of it on that side; but the traveller is sometimes in danger of being crushed by the fall of pieces of the rock from the precipices above. The river Conway, though its course from the lake out of which it issues to its mouth is only 12 miles, yet is so deep, in consequence of the many brooks it receives, that it is navigable by ships of good burden for eight miles. Pearls are found in a large black muscle taken in this river. The principal towns are Bangor, Caernarvon the capital, and Conway. In this county is an ancient road said to have been made by Helena the mother of Constantine the Great; and Matthew of Westminster asserts, that the body of Constantius the father of the same Constantine was found at Caernarvon in the year 1283, and interred in the parish-church there by order of Edward I.

CAERNARVON, a town of Wales, and capital of the county of that name. It was built by Edward I. near the site of the ancient Segontium, after his conquest of the country in 1282, the situation being well adapted to overawe his new subjects. It had natural requisites for strength; being bounded on one side by the arm of the sea called the *Menai;* by the estuary of the

Caernarvon || Cæsalpinia.

Seiont on another, exactly where it receives the tide from the former; on a third side, and a part of the fourth, by a creek of the Menai; and the remainder has the appearance of having the insulation completed by art. Edward undertook this great work immediately after his conquest of the country in 1282, and completed the fortifications and castle before 1284; for his queen, on April 25th in that year, brought forth within its walls Edward, first prince of Wales of the English line. It was built within the space of one year, by the labour of the peasants, and at the cost of the chieftains of the country, on whom the conqueror imposed the hateful task. The external state of the walls and castle, Mr Pennant informs us, are at present exactly as they were in the time of Edward. The walls are defended by numbers of round towers, and have two principal gates: the east, facing the mountains; the west, upon the Menai. The entrance into the castle is very august, beneath a great tower, on the front of which appears the statue of the founder, with a dagger in his hand, as if menacing his new-acquired unwilling subjects. The gate had four portcullises, and every requisite of strength. The towers are very beautiful. The Eagle tower is remarkably fine, and has the addition of three slender angular turrets issuing from the top. Edward II. was born in a little dark room in this tower, not twelve feet long nor eight in breadth: so little did, in those days, a royal consort consult either pomp or conveniency. The gate through which the affectionate Eleanor entered, to give the Welsh a prince of their own, who could not speak a word of English, is at the farthest end, at a vast height above the outside ground; so could only be approached by a draw-bridge. The quay is a most beautiful walk along the side of the Menai, and commands a most agreeable view.

Caernarvon is destitute of manufactures, but has a brisk trade with London, Bristol, Liverpool, and Ireland, for the several necessaries of life. It is the residence of numbers of genteel families, and contains several very good houses. Edward I. bestowed on this town its first royal charter, and made it a free borough. Among other privileges, none of the burgesses could be convicted of any crime committed between the rivers Conway and Dyfe, unless by a jury of their own townsmen. It is governed by a mayor, who, by patent, is created governor of the castle. It has one alderman, two bailiffs, a town-clerk, and two serjeants at mace. The representative of the place is elected by its burgesses, and those of Conway, Pwllheli, Nefyn, and Crickaeth. The right of voting is in every one, resident or non-resident, admitted to their freedom. The town gives title of *earl* and *marquis* to the duke of Chandos, and has a good tide-harbour.

CAERWIS, a market-town of Flintshire in North Wales, situated in W. Long. 3. 25. N. Lat. 53. 20.

CÆSALPINIA BRASILETTO, or *Brasil-wood:* a genus of the monogynia order, belonging to the decandria class of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The calyx is quinquefid, with the lowest segment larger in proportion. There are five petals, with the lowest more beautiful than the rest. It is a leguminous plant. Of this there are three species, the most remarkable of which is the brasiliensis, commonly called *Brasiletto*. It grows naturally in the warmest parts of America, from whence the wood is exported for the dyers, who use it much. The demand has been so great, that none of the large trees are left in any of the British plantations: so that Mr Catesby owns himself ignorant of the dimensions to which they grow. The largest remaining are not above two inches in thickness, and eight or nine feet in height. The branches are slender and full of small prickles; the leaves are pinnated; the lobes growing opposite to one another, broad at their ends, with one notch. The flowers are white, papilionaceous, with many stamina and yellow apices, growing in a pyramidal spike, at the end of a long slender stalk; the pods inclose several small round seeds. The colour produced from this wood is greatly improved by solution of tin in aqua regia.* The second sort is a native of the same countries with the first, but is of a larger size. It sends out many weak irregular branches, armed with short, strong, upright thorns. The leaves branch out in the same manner as the first; but the lobes, or small leaves, are oval and entire. The flowers are produced in long spikes like those of the former, but are variegated with red. These plants may be propagated in England from seeds, which should be sown in small pots filled with light rich earth early in the spring, and plunged in a bed of tanner's bark. Being tender, they require to be always kept in the stove, and to be treated in the same manner as other exotics of that kind.

Cæsalpinus || Cæsar.

Plate CXV.

* See *Colour making* and *Dyeing*.

CÆSALPINUS of Arezzo, professor at Pisca, and afterwards physician to pope Clement VIII. one of the capital writers in botany. See BOTANY, p. 419. 420.

CÆSAR, (Julius) the illustrious Roman general and historian, was of the family of the Julii, who pretended they were descended from Venus by Æneas. The descendants of Ascanius son of Æneas and Creusa, and surnamed *Julius*, lived at Alba till that city was ruined by Tullus Hostilius king of Rome, who carried them to Rome, where they flourished. We do not find that they produced more than two branches. The first bore the name of *Tullus*, the other that of *Cæsar*. The most ancient of the Cæsars were those who were in public employments in the 11th year of the first Punic war. After that time we find there was always some of that family who enjoyed public offices in the commonwealth, till the time of Caius Julius Cæsar, the subject of this article. He was born at Rome the 12th of the month Quintilis, year of the city 653, and lost his father an. 669. By his valour and eloquence he soon acquired the highest reputation in the field and in the senate. Beloved and respected by his fellow-citizens, he enjoyed successively every magisterial and military honour the republic could bestow consistent with its own free constitution. But at length having subdued Pompey the great rival of his growing power, his boundless ambition effaced the glory of his former actions: for, pursuing his favourite maxim, "that he had rather be the first man in a village than the second in Rome," he procured himself to be chosen perpetual dictator: and, not content with this unconstitutional power, his faction had resolved to raise him to the imperial dignity; when the friends of the civil liberties of the republic rashly assassinated him in the senate-house, where they should only have seized him and brought him to a legal trial for usurpation. By this

impolitic

Cæsar.

impolitic measure they defeated their own purpose, involving the city in consternation and terror, which produced general anarchy, and paved the way to the revolution they wanted to prevent; the monarchial government being absolutely founded on the murder of Julius Cæsar. He fell in the 56th year of his age, 43 years before the Christian æra. His commentaries contain a history of his principal voyages, battles, and victories. The London edition in 1712, in folio, is preferred.

The detail of Cæsar's transactions (so far as is consistent with the limits of this work) being given under the article ROME, we shall here only add a portrait of him as drawn by a philosopher.*

* From the *Melanges Philosophiques* of M. Ophellot.

"If, after the lapse of 18 centuries, the truth may be published without offence, a philosopher might, in the following terms, censure Cæsar without calumniating him, and applaud him without exciting his blushes.

"Cæsar had one predominant passion: it was the love of glory; and he passed 40 years of his life in seeking opportunities to foster and encourage it. His soul, entirely absorbed in ambition, did not open itself to other impulses. He cultivated letters; but he did not love them with enthusiasm, because he had not leisure to become the first orator of Rome. He corrupted the one half of the Roman ladies, but his heart had no concern in the fiery ardours of his senses. In the arms of Cleopatra, he thought of Pompey; and this singular man, who disdained to have a partner in the empire of the world, would have blushed to have been for one instant the slave of a woman.

"We must not imagine, that Cæsar was born a warrior, as Sophocles and Milton were born poets. For, if nature had made him a citizen of Sybaris, he would have been the most voluptuous of men. If in our days he had been born in Pennsylvania, he would have been the most inoffensive of quakers, and would not have disturbed the tranquillity of the new world.

"The moderation with which he conducted himself after his victories, has been highly extolled; but in this he showed his penetration, not the goodness of his heart. Is it not obvious, that the display of certain virtues is necessary to put in motion the political machine? It was requisite that he should have the appearance of clemency, if he inclined that Rome should forgive him his victories. But what greatness of mind is there in a generosity which follows on the usurpation of supreme power?

"Nature, while it marked Cæsar with a sublime character, give him also that spirit of perseverance which renders it useful. He had no sooner begun to reflect, than he admired Sylla; hated him, and yet wished to imitate him. At the age of 15, he formed the project of being dictator. It was thus that the president Montesquieu conceived, in his early youth, the idea of the spirit of laws.

"Physical qualities, as well as moral causes, contributed to give strength to his character. Nature, which had made him for command, had given him an air of dignity. He had acquired that soft and insinuating eloquence, which is perfectly suited to seduce vulgar minds, and has a powerful influence on the most cultivated. His love of pleasure was a merit with the fair sex; and women, who even in a republic can draw to them the suffrages and attention of men, have the highest importance in degenerate times. The ladies of his age were charmed with the prospect of having a dictator whom they might subdue by their attractions.

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"In vain did the genius of Cato watch for some time to sustain the liberty of his country. It was unequal to contend with that of Cæsar. Of what avail were the eloquence, the philosophy, and the virtue of this republican, when opposed by a man who had the address to debauch the wife of every citizen whose interest he meant to engage; who, possessing an enthusiasm for glory, wept, because, at the age of 30, he had not conquered the world like Alexander; and who, with the haughty temper of a despot, was more desirous to be the first man in a village than the second in Rome.

"Cæsar had the good fortune to exist in times of trouble and civil commotions, when the minds of men are put into a ferment; when opportunities of great actions are frequent; when talents are every thing, and those who can only boast of their virtues are nothing. If he had lived an hundred years sooner, he would have been no more than an obscure villain; and, instead of giving laws to the world, would not have been able to produce any confusion in it.

"I will here be bold enough to advance an idea, which may appear paradoxical to those who weakly judge of men from what they atchieve, and not from the principle which leads them to act. Nature formed in the same mould Cæsar, Mahomet, Cromwell, and Kouli Khan. They all of them united to genius that profound policy which renders it so powerful. They all of them had an evident superiority over those with whom they were surrounded; they were conscious of this superiority, and they made others conscious of it. They were all of them born subjects, and became fortunate usurpers. Had Cæsar been placed in Persia, he would have made the conquest of India; in Arabia, he would have been the founder of a new religion; in London, he would have stabbed his sovereign, or have procured his assassination under the sanction of the laws. He reigned with glory over men whom he had reduced to be slaves; and, under one aspect, he is to be considered as a hero; under another, as a monster. But it would be unfortunate, indeed, for society, if the possession of superior talents gave individuals a right to trouble its repose. Usurpers accordingly have flatterers, but no friends; strangers respect them; their subjects complain and submit; it is in their own families that humanity finds her avengers. Cæsar was assassinated by his son, Mahomet was poisoned by his wife, Kouli Khan was massacred by his nephew, and Cromwell only died in his bed because his son Richard was a philosopher.

"Cæsar, the tyrant of his country; Cæsar, who destroyed the agents of his crimes, if they failed in address; Cæsar, in fine, the husband of every wife, and the wife of every husband; has been accounted a great man by the mob of writers. But it is only the philosopher who knows how to mark the barrier between celebrity and greatness. The talents of this singular man, and the good fortune which constantly attended him till the moment of his assassination, have concealed the enormity of his actions."

CÆSAR, in Roman antiquity, a title borne by all the

the emperors, from Julius Cæsar to the destruction of the empire. It was also used as a title of distinction for the intended or presumptive heir of the empire, as *king of the Romans* is now used for that of the German empire.

This title took its rise from the surname of the first emperor, C. Julius Cæsar, which, by a decree of the senate, all the succeeding emperors were to bear. Under his successor, the appellation of *Augustus* being appropriated to the emperors in compliment to that prince, the title *Cæsar* was given to the second person in the empire, though still it continued to be given to the first; and hence the difference betwixt Cæsar used simply, and Cæsar with the addition of Imperator Augustus.

The dignity of Cæsar remained to the second of the empire, till Alexius Comnenus having elected Nicephorus Melissenus Cæsar, by contract; and it being necessary to confer some higher dignity on his own brother Isaacius, he created him Sebastocrator, with the precedency over Melissenus; ordering, that in all acclamations, &c. Isaacius Sebastocrator should be named the second, and Melissenus Cæsar the third.

Cæsar (Sir Julius), a learned civilian was descended by the female line from the duke de Cesarini in Italy; and was born near Tottenham in Middlesex, in the year 1557. He was educated at Oxford, and afterwards studied in the university of Paris, where, in the year 1581, he was created doctor of the civil law, and two years after was admitted to the same degree at Oxford, and also became doctor of the canon law. He was advanced to many honourable employments, and for the last 20 years of his life was master of the rolls. He was remarkable for his extensive bounty and charity to all persons of worth, so that he seemed to be the almoner-general of the nation. He died 1639, in the 79th year of his age. It is very remarkable that the manuscripts of this lawyer were offered (by the executors of some of his descendants) to a cheesemonger for waste-paper; but being timely inspected by Mr Samuel Patterson, this gentleman discovered their worth, and had the satisfaction to find his judgment confirmed by the profession, to whom they were sold in lots for upwards of 500*l.* in the the year 1757.

*Cæsar Augusta*, or *Cæsarea Augusta*, (anc. geog.) a Roman colony situated on the river Iberus in the hither Spain, before called *Salduba*, in the territories of the Edetani. Now commonly thought to be Saragosa.

CÆSAREA, the name of several ancient cities, particularly one on the coast of Phenice. It was very conveniently situated for trade; but had a very dangerous harbour, so that no ships could be safe in it when the wind was at south-west. Herod the Great king of Judea remedied this inconveniency at an immense expence and labour, making it one of the most convenient havens on that coast. He also beautified it with many buildings, and bestowed 12 years in the finishing and adorning it.

CÆSARIAN operation. See Midwifery.

CÆSARIANS, *Cæsarienses*, in Roman antiquity, were officers or ministers of the Roman emperors: They kept the account of the revenues of the emperors; and took possession, in their name, of such things as devolved or were confiscated to them.



CÆSARODUNUM, (anc. geog.) a town of the Turones in Celtic Gaul; now *Tours*, the capital of Touraine. See Tours.

CÆSAROMAGUS, (anc. geog.) a town of the Trinobantes in Britain; by some supposed to be *Chelmsford*, by others *Brentford*, and by others *Burstet*.

CÆSENA, (anc. geog.) a town of Gallia Cispadana, situated on the rivers Isapis and Rubicon; now Cæsena, which see.

CÆSIA sylva, (anc. geog.) a wood in Germany, part of the great Sylva Hercynia, situated partly in the duchy of Cleves, and partly in Westphalia between Wesel and Kesfield..

CÆSONES, a denomination given to those cut out of their mother's wombs. Pliny ranks this as an auspicious kind of birth; the elder Scipio Africanus, and the first family of Cæsars, were brought into the world in this way.

CÆSTUS, in antiquity, a large gantlet made of raw hide, which the wrestlers made use of when they fought at the public games.—This was a kind of leathern strap, strengthened with lead or plates of iron, which encompassed the hand, the wrist, and a part of the arm, as well to defend these parts as to enforce their blows.

Cæstus, or *Cæstum*, was also a kind of girdle, made of wool, which the husband untied for his spouse the first day of mariage, before they went to bed.

This relates to Venus's girdle, which Juno borrowed of her to entice Jupiter to love her. See Cestus.

CÆSURA, in the ancient poetry, is when, in the scanning of a verse, a word is divided so, as one part seems cut off, and goes to a different foot from the rest; as,

*Menti|ri no|li, nun|quam men|dacia |prosunt.*

where the syllables *ri*, *li*, *quam*, and *men*, are cæsuras.

Cæsure, in the modern poetry, denotes a rest or pause towards the midle of an Alexandrian verse, by which the voice and pronunciation are aided, and the verse, as it were, divided into two hemistichs. See Pause.

CÆTERIS paribus, a Latin term in frequent use among mathematical and physical writers. The words literally signify, *the rest* (or *other things*) *being alike or equal.* Thus we say the heavier the bullet, *cæteris paribus*, the greater the range; *i. e.* by how much the bullet is heavier, if the length and diameter of the piece and strength of the powder be the same, by so much will the utmost range or distance of a piece of ordnance be the greater. Thus also, in a physical way, we say, the velocity and quantity circulating in a given time through any section of any artery, will, *cæteris paribus*, be according to its diameter, and nearness to or distance from the heart.

CÆTOBRIX, (anc. geog.) a town of Lusitania, near the mouth of the Tagus on the east side; now extinct. It had its name from its fishery; and there are still extant fish-ponds on the shore, done with plaster of Paris, which illustrate the name of the ruined city.

CAFFA, in commerce, painted cotton-cloths manufactured in the East Indies, and sold at Bengal.

Caffa, or *Kaffa*, a city and port-town of Crim Tartary, situated on the south-east part of that peninsula. E. Long. 37. 0. N. Lat. 44. 55.

It is the most considerable town in the country, and gives name to the straits of Caffa, which runs from the Euxine or black Sea, to the Palus Meotis, or sea of Azoph.

CAFFILA, a company of merchants or travellers, who join together in order to go with more security through the dominions of the Grand Mogul, and through other countries on the continent of the East Indies.

The Caffila differs from a caravan, at least in Persia: for the caffila belongs properly to some sovereign, or to some powerful company in Europe, whereas a caravan is a company of particular merchants, each trading upon his own account. The English and Dutch have each of them their caffila at Gambrow. There are also such caffilas, which cross some parts of the desarts of Africa, particularly that called the *sea of sand*, which lies between the kingdom of Morocco and those of Tombut and Gaigo. This is a journey of 400 leagues; and takes up two months in going, and as many in coming back; the caffila travelling only by night, on account of the excessive heat of that country. The chief merchandize they bring back consists in gold dust, which they call *atibar*, and the Europeans *tibir*.

CAFFILA on the coast of Guzerat or Cambaya, signifies a small fleet of merchant-ships.

CAFFRARIA, the country of the Caffres or Hottentots, in the most southerly parts of Africa, lying in the form of a crescent about the inland country of Monomopata, between 35° south latitude and the tropic of Capricorn: and bounded on the east, south, and west by the Indian and Atlantic oceans. See HOTTENTOTS.

Most of the sea-coasts of this country are subject to the Dutch, who have built a fort near the most southern promontory, called the *Cape of Good Hope*.

CAG, or KEG, a barrel or vessel, that contains from four to five gallons.

CAGANUS, or CACANUS, an appellation anciently given by the Huns to their kings. The word appears also to have been formerly applied to the princes of Muscovy, now called *czar*. From the same also, probably, the Tartar title *cham* or *can*, had its origin.

CAGE, an inclosure made of wire, wicker, or the like interwoven lattice-wise, for the confinement of birds or wild beasts. The word is French, *cage*, formed from the Italian *gaggia*, of the Latin *cavea*, which signifies the same: *a caveis theatralibus in quibus includebantur feræ*.

Beasts were usually brought to Rome shut up in oaken or beechen cages, artfully formed, and covered or shaded with boughs, that the creatures, deceived with the appearance of a wood, might fancy themselves in their forest. The fiercer sort were pent in iron cages, lest wooden prisons should be broke through. In some prisons there are iron cages for the closer confinement of criminals. The French laws distinguish two sorts of bird-cages, viz. high or singing cages, and low or dumb-cages; those who expose birds to sale are obliged to put the hens in the latter, and the cocks in the former, that persons may not be imposed on by buying a hen for a cock.

CAGES, (*caveæ*) denote also places in the ancient amphitheatres, wherein wild beasts were kept, ready to be let out for sport. The *caveæ* were a sort of iron cages different from dens, which were under ground and dark; whereas the *caveæ* being airy and light, the beasts rushed out of them with more alacrity and fierceness than if they had been pent under ground.

CAGE, in carpentry, signifies an outer-work of timber, enclosing another within it. In this sense we say, *the cage of a wind-mill*. The cage of a stair-case denotes the wooden sides or walls which inclose it.

CAGEAN, or CAGAYAN, a province of the island of Lytzen, or Manila, in the East Indies. It is the largest in the island, being 80 leagues in length, and 40 in breadth. The principal city is called *New Segovia*, and 15 leagues eastward from this city lies cape Bajador. Doubling that cape, and coasting along 20 leagues from north to south, the province of Cagean ends, and that of Illocos begins. The peaceable Cageans who pay the tribute are about 9000; but there are a great many not subdued. The whole province is fruitful: the men apply themselves to agriculture, and are of a martial disposition; and the women apply to several works in cotton. The mountains afford food for a vast number of bees; in consequence of which wax is so plenty, that all the poor burn it instead of oil. They make their candles after the following manner: they leave a small hole at each end of a hollow stick for the wick to run through; and then, stopping the bottom, fill it with wax at the top: when cold, they break the mould, and take out the candle. On the mountains there is abundance of brasil, ebony, and other valuable woods. In the woods are store of wild beasts, as boars; but not so good as those of Europe. There are also abundance of deer, which they kill for their skins and horns to sell to the Chinese.

CAGLI, an ancient episcopal town of Italy, in the duchy of Urbino, situated at the foot of the Apennine mountains. E. Long. 14. 12. N. Lat. 43. 30.

CAGLIARI, (Paolo) called *Paulo Veronese*, an excellent painter, was born at Verona in the year 1532. Gabriel Cagliari his father was a sculptor, and Antonio Badile his uncle was his master in painting. He was not only esteemed the best of all the Lombard painters, but for his extensive talents in the art was peculiarly styled *Il pittor felice*, "the happy painter;" and there is scarcely a church in Venice where some of his performances are not to be seen. De Piles says, that "his picture of the marriage at Cana, in the church of St George, is to be distinguished from his other works, as being not only the triumph of Paul Veronese, but almost the triumph of painting itself." When the senate sent Grimani, procurator of St Mark, to be their ambassador at Rome, Paul attended him, but did not stay long, having left some pieces at Venice unfinished. Philip II. king of Spain, sent for him to paint the Escurial, and made him great offers; but Paul excused himself from leaving his own country, where his reputation was so well established, that most of the princes of Europe ordered their several ambassadors to procure something of his hand at any rate. He was indeed highly esteemed by all the principal men in his time; and so much admired by the great masters, as well his contemporaries, as those who succeeded him, that Titian himself used to say, he was the ornament of his profession. And Guido Reni being asked which of the masters his predecessors he would choose to be, were it in his power, after Raphael and Correggio,

gio, named Paul Veronese; whom he always called his Paolino. He died of a fever at Venice in 1588, and had a tomb and a statue of brass erected to his memory in the church of St Sebastian. He left great wealth to his two sons Gabriel and Charles, who lived happily together, and joined in finishing several of their father's imperfect pieces with good success.

CAGLIARI, an ancient, large, and rich town, capital of the island of Sardinia in the Mediterranean. It is seated on the declivity of an hill, is an university, an archbishopric, and the residence of the viceroy. It has an excellent harbour, and a good trade; but is a place of no great strength. It was taken, with the whole island, by the English in 1708, who transferred it to the emperor Charles the VI.; but it was retaken by the Spaniards in 1717, and about two years afterwards ceded to the duke of Savoy in lieu of Sicily, and hence he has the title of *king of Sardinia*. E. Long. 9. 14. N. Lat. 39. 12.

CAGUI, in zoology, a sononyme of two species of monkeys, *viz.* the jacchus and œdipus. See SIMIA.

CAHORS, a considerable town of France, in Querci in Guienne, with a bishop's see and an university. It is seated on a peninsula made by the river Lot, and built partly on a craggy rock. The principal street is very narrow; and terminates in the market-place, in which is the town-house. The cathedral is a Gothic structure, and has a large square steeple. The fortifications are regular, and the town is surrounded with thick walls. E. Long. 1. 6. N. Lat. 44. 26.

CAHYS, a dry measure for corn, used in some parts of Spain, particularly at Seville and at Cadiz. It is near a bushel of our measure.

CAJANABURG, the capital of the province of Cajania or East Bothnia in Sweden, situated on the north-east part of the lake Cajania, in E. Long. 27. 0. N. Lat. 63. 50.

CAIPHAS, high-priest of the Jews after Simon, condemned Christ to death; and was put out of his place by the emperor Vitellius, for which disgrace he made away with himself.

CAJAZZO, a town of the province of Lavoro in the kingdom of Naples, situated in E. Long. 15. 0. N. Lat. 41. 15.

CAICOS, the name of some American islands to the north of St Domingo, lying from W. Long. 112. 10. to 113. 16. N. Lat. 21. 40.

CAJEPUT, an oil brought from the East Indies resembling that of Cardamoms.

CAIETA, (anc. geog.) a port and town of Latium, so called from Æneas's nurse; now *Gaeta*, which see.

CAJETAN, (Cardinal) was born at Cajeta in the kingdom of Naples in the year 1469. His proper name was *Thomas de Vio*; but he adopted that of *Cajetan* from the place of his nativity. He defended the authority of the Pope, which suffered greatly at the council of Nice, in a work entitled *Of the power of the Pope*; and for this work he obtained the bishopric of Cajeta. He was afterwards raised to the archiepiscopal see of Palermo, and in 1517 was made a cardinal by Pope Leo. X. The year after, he was sent as legate into Germany, to quiet the commotions raised against indulgences by Martin Luther; but Luther, under protection of Frederic elector of Saxony, set him at defiance; for though he obeyed the cardinal's summons in repairing to Augsburg, yet he rendered all his proceedings ineffectual. Cajetan was employed in several other negociations and transactions, being as ready at business as at letters. He died in 1534. He wrote Commentaries upon Aristotle's philosophy, and upon Thomas Aquinas's theology; and made a literal translation of the Old and New Testaments.



CAIFONG, a large, populous, and rich town of Asia, in China, seated in the middle of a large and well cultivated plain. It stands in a bottom; and when besieged by the rebels in 1642, they ordered the dykes of the river Hohangho to be cut, which drowned the city, and destroyed 300,000 of its inhabitants. E. Long. 113. 27. N. Lat. 35. 0.

CAILLE, (Nicholas Louis de la) an eminent mathematician and astronomer, was born at a small town in the diocese of Rheims in 1713. His father had served in the army, which he quitted, and in his retirement studied mathematics; and amused himself with mechanic exercises, wherein he proved the happy author of several inventions of considerable use to the public. Nicholas, almost in his infancy, took a fancy to mechanics, which proved of signal service to him in his maturer years. He was sent young to school at Mantes-sur-Seine, where he discovered early tokens of genius. In 1729, he went to Paris; where he studied the classics, philosophy, and mathematics. Afterwards he went to study divinity at the college de Navarre, proposing to embrace an ecclesiastical life. At the end of three years he was ordained a deacon, and officiated as such in the church of the college de Mazarin several years; but he never entered into priests orders, apprehending that his astronomical studies, to which he became most assiduously devoted, might too much interfere with his religious duties. In 1739, he was conjoined with M. de Thury, son to M. Cassini, in verifying the meridian of the royal observatory through the whole extent of the kingdom of France. In the month of November the same year, whilst he was engaged day and night in the operations which this grand undertaking required, and at a great distance from Paris, he was, without any solicitation, elected into the vacant mathematical chair which the celebrated M. Varignon had so worthily filled. Here he began to teach about the end of 1740; and an observatory was ordered to be erected for his use in the college, and furnished with a suitable apparatus of the best instruments. In May 1741, M. de la Caille was admitted into the royal academy of sciences as an adjoint member for astronomy. Besides the many excellent papers of his dispersed up and down in their memoirs, he published Elements of geometry, mechanics, optics, and astronomy. Moreover, he carefully computed all the eclipses of the sun and moon that had happened since the Christian æra, which were printed in a book published by two Benedictines, entitled *l'Art de verefier les dates*, &c. Paris, 1750, in 4to. Besides these, he compiled a volume of astronomical ephemerides for the years 1745 to 1755; another for the years 1755 to 1765; a third for the years 1765 to 1775; an excellent work entitled *Astronomiæ fundamenta novissimi solis et stellarum observationibus stabilita*; and the most correct solar tables that ever appeared. Having gone through a seven years series of astronomical observations in his own observatory, he formed a project of going to observe the southern stars at the Cape

Caille.

Cape of Good Hope. This was highly approved by the academy, and by the prime minister Comte de Argenson, and very readily agreed to by the states of Holland. Upon this, he drew up a plan of the method he proposed to pursue in his southern observations; setting forth, that besides settling the places of the fixed stars, he proposed to determine the parallax of the moon, Mars, and Venus. But whereas this required correspondent observations to be made in the northern parts of the world, he sent to those of his correspondents who were expert in practical astronomy previous notice, in print, what observations he designed to make at such and such times for the said purpose. At length, on the 21st of November 1750, he sailed for the Cape, and arrived there on the 19th of April 1751. He forthwith got his instruments on shore; and, with the assistance of some Dutch artificers, set about building an astronomical observatory, in which his apparatus of instruments was properly disposed of as soon as it was in a fit condition to receive them.

The sky at the Cape is generally pure and serene, unless when a south-east wind blows. But this is often the case; and when it is, it is attended with some strange and terrible effects. The stars look bigger, and seem to caper; the moon has an undulating tremor; and the planets have a sort of beard like comets. Two hundred and twenty-eight nights did our astronomer survey the face of the southern heavens; during which space, which is almost incredible, he observed more than 10,000 stars; and whereas the ancients filled the heavens with monsters and old-wives tales, the abbe de la Caille chose rather to adorn them with the instruments and machines which modern philosophy has made use of for the conquest of nature*. With no less success did he attend to the parallax of the moon, Mars, Venus, and the sun. Having thus executed the purpose of his voyage, and no present opportunity offering for his return, he thought of employing the vacant time in another arduous attempt; no less than that of taking the measure of the earth, as he had already done that of the heavens. This indeed had, through the munificence of the French king, been done before by different sets of learned men both in Europe and America: some determining the quantity of a degree under the equator, and others under the arctic circle: but it had not as yet been decided whether in the southern parallels of latitude the same dimensions obtained as in the northern. His labours were rewarded with the satisfaction he wished for; having determined a distance of 410,814 feet from a place called *Klip-Fontyn* to the Cape, by means of a base of 38,802 feet, three times actually measured: whence he discovered a new secret of nature, namely, that the radii of the parallels in south latitude are not the same as those of the corresponding parallels in north latitude. About the 23d degree of south latitude he found a degree on the meridian to contain 342,222 Paris feet. He returned to Paris the 27th of September 1754; having in his almost four years absence expended nomore than 9144 livres on himself and his companion; and at his coming into port, he refused a bribe of 100,000 livres, offered by one who thirsted less after glory than gain, to be sharer in his immunity from customhouse searches.

* See the Planisphere in his *Cælum australe stelliferum*.

After receiving the congratulatory visits of his more intimate friends and the astronomers, he first of all thought fit to draw up a reply to some strictures which professor Euler had published relative to the meridian, and then he settled the results of the comparison of his own with the observations of other astronomers for the parallaxes. That of the sun he fixed at $9\frac{1}{4}''$; of the moon, at $56'\ 56''$; of Mars in his opposition, $36''$; of Venus, $38''$. He also settled the laws whereby astronomical refractions are varied by the different density or rarity of the air, by heat or cold, and dryness or moisture. And, lastly, he showed an easy, and by common navigators practicable, method of finding the longitude at sea by means of the moon, which he illustrated by examples selected from his own observations during his voyages. His fame being now established upon so firm a basis, the most celebrated academies of Europe claimed him as their own: and he was unanimously elected a member of the royal society at London; of the institute of Bologna; of the imperial academy at Petersburg; and of the royal academies of Berlin, Stockholm, and Gottingen. In the year 1760, Mr de la Caille was attacked with a severe fit of the gout; which, however, did not interrupt the course of his studies; for he then planned out a new and immense work, no less than a history of astronomy through all ages, with a comparison of the ancient and modern observations, and the construction and use of the instruments employed in making them. In order to pursue the task he had imposed upon himself in a suitable retirement, he obtained a grant of apartments in the royal palace of Vincennes; and whilst his astronomical apparatus was erecting there, he began printing his Catalogue of the southern stars, and the third volume of his Ephemerides. The state of his health was, towards the end of the year 1763, greatly reduced. His blood grew inflamed; he had pains of the head, obstructions of the kidneys, loss of appetite, with an oppletion of the whole habit. His mind remained unaffected, and he resolutely persisted in his studies as usual. In the month of March, medicines were administered to him, which rather aggravated than alleviated his symptoms; and he was now sensible, that the same distemper which in Africa, ten years before, yielded to a few simple remedies, did in his native country bid defiance to the best physicians. This induced him to settle his affairs; his manuscripts he committed to the care and discretion of his esteemed friend M. Maraldi. It was at last determined that a vein should be opened; but this brought on an obstinate lethargy, of which he died, aged 49.

Caille | Caiman Islands.

CAIMACAN, or CAIMACAM, in the Turkish affairs, a dignity in the Ottoman empire, answering to lieutenant, or rather deputy, amongst us.

There are usually two Caimacans; one residing at Constantinople, as governor thereof; the other attending the grand vizir in quality of his lieutenant, secretary of state, and first minister of his council, and gives audience to ambassadors. Sometimes there is a third caimacan, who attends the sultan; whom he acquaints with any public disturbances, and receives his orders concerning them.

CAIMAN ISLANDS, certain American islands lying south of Cuba, and north-west of Jamaica, between 81° and 86° of west longitude, and in 21 of north latitude. They are most remarkable on account of the fishery of tortoise, which the people of Jamaica catch here, and carry home alive, keeping them in pens for food, and killing them as they want them.

CAIN, eldest son of Adam and Eve, killed his brother Abel; for which he was condemned by God to banishment and a vagabond state of life. Cain retired to the land of Nod, on the east of Eden; and built a city, to which he gave the name of his son Enoch.

CAINITES, a sect of heretics in the 2d century, so called on account of their great respect for Cain. They pretended that the virtue which produced Abel was of an order inferior to that which had produced Cain, and that this was the reason why Cain had the victory over Abel and killed him; for they admitted a great number of genii, which they called *virtues*, of different ranks and orders. They made profession of honouring those who carry in Scripture the most visible marks of reprobation; as the inhabitants of Sodom, Esau, Korah, Dathan, and Abiram. They had, in particular a very great veneration for the traitor Judas, under pretence that the death of Jesus Christ had saved mankind. They had a forged gospel of Judas, to which they paid great respect.

CAIRNS, or CARNES, the vulgar name of those heaps of stones which are to be seen in many places of Britain, particularly Scotland and Wales.—They are composed of stones of all dimensions thrown together in a conical form, a flat stone crowning the apex; (see Plate CXXVII.)

Various causes have been assigned by the learned for these heaps of stones. They have supposed them to have been, in times of inauguration, the places where the chieftain-elect stood to show himself to best advantage to the people; or the place from whence judgment was pronounced; or to have been erected on the road-side in honour of Mercury; or to have been formed in memory of some solemn compact, particularly where accompanied by standing pillars of stones; or for the celebration of certain religious ceremonies. Such might have been the reasons, in some instances, where the evidences of stone-chests and urns are wanting: but these are so generally found, that they seem to determine the most usual purpose of the piles in question to have been for sepulchral monuments. Even this destination might render them suitable to other purposes; particularly religious, to which by their nature they might be supposed to give additional solemnity.—According to Toland, fires were kindled on the tops or flat stones, at certain times of the year, particularly on the eves of the 1st of May and the 1st of November, for the purpose of sacrificing; at which time all the people having extinguished their domestic hearths rekindled them from the sacred fires of the cairns. In general, therefore, these accumulations appear to have been designed for the sepulchral protection of heroes and great men. The stone-chests, the repository of the urns and ashes, are lodged in the earth beneath: sometimes only one, sometimes more, are found thus deposited; and Mr Pennant mentions an instance of 17 being discovered under the same pile.

Cairns are of different sizes, some of them very large. Mr Pennant describes one in the island of Arran, 114 feet over and of a vast height. They may justly be supposed to have been proportioned in size to the rank of the person, or to his popularity: the people of a whole district assembled to show their respect to the deceased; and, by an active honouring of his memory, soon accumulated heaps equal to those that astonish us at this time. But these honours were not merely those of the day; as long as the memory of the deceased endured, not a passenger went by without adding a stone to the heap: they supposed it would be an honour to the dead, and acceptable to his manes.



*Quanquam festinas, non est mora longa: licebit*
*Injecto ter pulvere, curras.*

To this moment there is a proverbial expression among the highlanders allusive to the old practice: a suppliant will tell his patron, *Curri mi cloch er do charne*, "I will add a stone to your cairn;" meaning, When you are no more, I will do all possible honour to your memory.

Cairns are to be found in all parts of the islands, in Cornwal, Wales, and all parts of North Britain; they were in use among the northern nations; Dahlberg, in his 323d plate, has given the figure of one. In Wales they are called *carneddau;* but the proverb taken from them there, is not of the complimental kind; *Karn ar dy ben*, or, "A cairn on your head," is a token of imprecation.

CAIRO, or GRAND CAIRO, the capital of Egypt, situated in a plain at the foot of a mountain, in E. Long. 32. 0. N. Lat. 30. 0. It was founded by Jawhar, a Magrebian general, in the year of the Hegira 358. He had laid the foundations of it under the horoscope of Mars; and for that reason gave his new city the name of *Al Kahirah*, or the *Victorious*, an epithet applied by the Arab astronomers to that planet. In 362 it became the residence of the kaliffs of Egypt, and of consequence the capital of that country, and has ever since continued to be so. It is divided into the New and Old cities. Old Cairo is on the eastern side of the river Nile, and is now almost uninhabited. The New, which is properly Cairo, is seated in a sandy plain about two miles and a half from the old city. It stands on the western side of the Nile, from which it is not three quarters of a mile distant. It is extended along the mountain on which the castle is built, for the sake of which it was removed hither, in order, as some pretend, to be under its protection. However, the change is much for the worse, as well with regard to air as water, and the pleasantness of the prospect. Bulack may be called the port of Cairo; for it stands on the bank of the Nile, about a mile and a half from it, and all the corn and other commodities are landed there before they are brought to the city. Some travellers have made Cairo of a most enormous magnitude, by taking in the old city Bulack, and the new; the real circumference of it, however, is not above ten miles, but it is extremely populous. The first thing that strikes a traveller is the narrowness of the streets, and the appearance of the houses. These are so daubed with mud on the outside, that you would think they were built with nothing else. Besides, as the streets are unpaved, and always full of people, the walking in them is very inconvenient, especially to strangers. To remedy this, there are a great number of asses, which always stand ready to be hired for a trifle, that is, a penny a mile. The owners drive them

them along, and give notice to the crowd to make way. And here it may be obſerved, that the Chriſtians in this, as well as other parts of the Turkiſh dominions, are not permitted to ride upon horſes. The number of the inhabitants can only be gueſſed at; but we may conclude it to be very great, becauſe in ſome years the plague will carry off 200,000, without their being much miſſed. The houſes are from one to two or three ſtories high, and flat at the top; where they take the air, and often ſleep all night. The better ſort of theſe have a court on the inſide like a college. The common run of houſes have very little room, and even among great people it is uſual for 20 or 30 to lie in the ſmall hall. Some houſes will hold 300 perſons of both ſexes, among whom are 20 or 30 ſlaves, and thoſe of ordinary rank have generally three or four.

There is a canal called *Halis*, which runs along the city from one end to the other, with houſes on each ſide, which make a large ſtraight ſtreet. Beſides this, there are ſeveral lakes, which are called *birks* in the language of the country. The principal of theſe, which is near the caſtle, is 500 paces in diameter. The moſt elegant houſes in the city are built on its banks; but what is extraordinary, eight months in the year it contains water, and the other four it appears with a charming verdure. When there is water ſufficient, it is always full of gilded boats, barges, and barks, in which people of condition take their pleaſure towards night, at which time there are curious fire-works, and variety of muſic.

New Cairo is ſurrounded with walls built with ſtone, on which are handſome battlements, and at the diſtance of every hundred paces there are very fine towers, which have room for a great number of people. The walls were never very high, and are in many places gone to ruin. The baſha lives in the caſtle, which was built by Saladine ſeven hundred years ago. It ſtands in the middle of the famous mountain Moketan, which terminates in this place, after it had accompanied the Nile from Ethiopia hither. This caſtle is the only place of defence in Egypt; and yet the Turks take no notice of its falling, inſomuch that in proceſs of time it will become a heap of rubbiſh. The principal part in it is a magnificent hall, environed with 12 columns of granite, of a prodigious height and thickneſs, which ſuſtain an open dome, under which Saladine diſtributed juſtice to his ſubjects. Round this dome there is an inſcription in relievo, which determines the date and by whom it was built. From this place the whole city of Cairo may be ſeen, and above 30 miles along the Nile, with the fruitful plains that lie near it, as well as the moſques, pyramids, villages, and gardens, with which theſe fields are covered. Theſe granite pillars were the work of antiquity, for they were got out of the ruins of Alexandria. There are likewiſe in the moſques and in the principal houſes no leſs than 40,000 more, beſides great magazines, where all kinds are to be had at very low rates. A janiſſary happened to find five in his garden, as large as thoſe in the caſtle; but could not find any machine of ſtrength ſufficient to move them, and therefore had them ſawed in pieces to make mill-ſtones. It is believed that there have been 30 or 40,000 of theſe pillars brought from Alexandria, where there are yet many more to be had.

The gates of Cairo are three, which are very fine and magnificent.

There are about 300 public moſques in this city, ſome of which have ſix minarets. The moſque of Aſhar hath ſeveral buildings adjoining, which were once a famous univerſity, and 14,000 ſcholars and ſtudents were maintained on the foundation; but has now not above 1400, and thoſe are only taught to read and write. All the moſques are built upon the ſame plan, and differ only in magnitude. The entrance is thro' the principal gate into a large ſquare, open on the top, but well paved. Round this are covered galleries, ſupported by pillars: under which they ſay their prayers, in the ſhade. On one ſide of the ſquare there are particular places with baſons of water, for the conveniency of performing the ablutions injoined by the Koran. The moſt remarkable part of the moſque, beſides the minaret, is the dome. This is often bold, well proportioned, and of an aſtoniſhing magnitude. The inſide ſtones are carved like lace, flowers, and melons. They are built ſo firm, and with ſuch art, that they will laſt 600 or 700 years. About the outward circumference there are large Arabic inſcriptions, in relievo, which may be read by thoſe who ſtand below, though they are ſometimes of a wonderful height.

The khanes or caravanſeras are numerous and large, with a court in the middle, like their houſes. Some are ſeveral ſtories high, and are always full of people and merchandiſe. The Nubians, the Abyſſinians, and other African nations, which come to Cairo, have one to themſelves, where they always meet with lodging. Here they are ſecure from inſults, and their effects are all ſafe. Beſides theſe, there is a bazar, or market, where all ſorts of goods are to be ſold. This is in a long broad ſtreet; and yet the crowd is ſo great, you can hardly paſs along. At the end of this ſtreet is another ſhort one, but pretty broad, with ſhops full of the beſt ſort of goods, and precious merchandiſe. At the end of this ſhort ſtreet there is a great khane, where all ſorts of white ſlaves are to be ſold. Farther than this is another khane, where a great number of blacks, of both ſexes, are expoſed to ſale. Not far from the beſt market-place is an hoſpital, and a moſque for mad-people. They alſo receive and maintain ſick people into this hoſpital, but they are poorly looked after.

Old Cairo has ſcarce any thing remarkable but the granaries of Joſeph; which are nothing but a high wall, lately built, which includes a ſquare ſpot of ground, where they depoſite wheat, barley, and other grain, which is a tribute to the baſha, paid by the owners of land. This has no other covering but the heavens, and therefore the birds are always ſure to have their ſhare. There is likewiſe a tolerable handſome church, which is made uſe of by the Copts, who are Chriſtians and the original inhabitants of Egypt. Joſeph's well is in the caſtle, and was made by king Mohammed about 700 years ago. It is called *Joſeph's well*, becauſe they attribute every thing extraordinary to that remarkable perſon. It is cut in a rock, and is 280 feet in depth. The water is drawn up to the top by means of oxen, placed on platforms, at proper diſtances, which turn about the machines that raiſe it. The deſcent is ſo ſloping, that, though there are no ſteps, the oxen can deſcend and aſcend with eaſe.

The river Nile, to which not only Cairo, but all Egypt is so much indebted, is now known to have its rise in Abyssinia. The increase of the Nile generally begins in May, and in June they commonly proclaim about the city how much it is risen. Over against old Cairo the Basha has a house, wherein the water enters to a column, which has lines at the distance of every inch, and marks at every two feet as far as 30. When the water rises to 22 feet, it is thought to be of a sufficient height; when it rises much higher, it does a great deal of mischief. There is much pomp and ceremony used in letting the water into the canal, or hali, abovementioned. The basha gives the first stroke towards the removal of the dike or dam. When the water has filled the canal and lakes in the city, and the numerous cisterns that are in the mosques and private houses, it is let into a vast plain, to the north-east; the extent of which is 50 miles. When the country is covered with water, it is no unpleasant sight to view the towns appearing like little islands, and the people passing and repassing in boats.

The inhabitants of Cairo are a mixture of Moors, Turks, Jews, Greeks, and Cophts, or Coptis. The only difference between the habit of the Moors and Coptis is their turbans; those of the Moors being white, and of the Coptis white striped with blue. The common people generally wear a long black loose frock, sewed together all down before. The Jews wear a frock of the same fashion, made of cloth; and their caps are like a high crowned hat, without brims, covered with the same cloth, but not so taper. The Jewish women's are not very unlike the men's, but more light and long. The Greeks are habited like the Turks, only their Turbans differ.

Provisions of all kinds are exceeding plenty; for 20 eggs may be bought for a parrah or penny, and bread is six times as cheap as with us. They have almost all sorts of flesh and fish; and in particular have tame buffaloes, which are very useful. They bring goats into the streets in great numbers, to sell their milk. Their gardens are well stocked with fruit-trees of various kinds, as well as roots, herbs, melons, and cucumbers. The most common flesh meat is mutton. The goats are very beautiful, and have ears two feet in length; but their flesh is in no great esteem.

CAIROAN, or CAIRWAN, a city of Africa, in the kingdom of Tunis, seated in a sandy barren soil, about five miles from the gulph of Capres. It has neither spring, well, nor river; for which reason they are obliged to preserve rain-water in tanks and cisterns. It was built by the Aglabites; and is the ancient Cyrene*, but hath now lost its splendor. There is still, however, a very superb mosque, and the tombs of the kings of Tunis are yet to be seen. E. Long. 9. 12. N. Lat. 35. 40.

* See *Barbary*.

CAISSON, in the military art, a wooden chest, into which several bombs are put, and sometimes filled only with gunpowder: this is buried under some work whereof the enemy intend to possess themselves, and, when they are masters of it, is fired, in order to blow them up.

CAISSON is also used for a wooden frame or chest used in laying the foundations of the piers of a bridge.

CAITHNESS, otherwise called the *shire of Wick*, is the most northern county of all Scotland; bounded on the east of the ocean, and by Strathnaver and Sutherland on the south and south-west: from these it is divided by the mountains Orde, and a continued ridge of hills as far as Knockfin, then by the whole course of the river Hallowdale. On the north it is washed by the Pentland or Putland frith, which flows between this county and the Orkneys. It extends 35 miles from north to south, and about 20 from east to west. The coast is rocky, and remarkable for a number of bays and promontories. Of these, the principal are Sandside-head to the west, pointing to the opening of Pentland frith; Orcas, now Holborn-head, and Dunnet-head, both pointing northward to the frith. Dunnet-head, is a peninsula about a mile broad, and seven in compass; affording several lakes, good pasture, excellent mill-stones, and a lead-mine. Scribister bay, on the north-west, is a good harbour, where ships may ride securely. Rice-bay, on the east side, extends three miles in breadth; but is of dangerous access, on account of some sunk rocks at the entrance. At the bottom of this bay appear the ruins of two strong castles, the seat of the earl of Caithness, called *Castle Sinclair*, and Gernego, joined to each other by a draw-bridge. Duncan's bay, otherwise called *Dunsby-head*, is the north-east point of Caithness, and the extremest promontory in Britain. At this place, the breadth of the frith does not exceed 12 miles, and in the neighbourhood is the ordinary ferry to the Orkneys. Here is likewise Clythe-ness pointing east, and Noshead pointing north-east. The sea in this place is very impetuous, being in continual agitation from violent counter-tides, currents, and vortices. The only island belonging to this county is that of Stroma, in the Pentland frith, at the distance of two miles from the main land, extending about a mile in length, and producing good corn. The navigation is here rendered very difficult by conflicting tides and currents, which at both ends of the island produce a great agitation in the sea. At the south end, the waves dance so impetuously, that the sailors term them the *merry men of May*, alluding to the house of one Mr May, on the opposite shore of Caithness, which served them as a land-mark, in the dangerous passage between the island and the continent. The property of this island was once disputed between the earls of Orkney and Caithness; but adjudged to the latter, in consequence of an experiment, by which it appeared, that venomous creatures will live in Stroma, whereas they die immediately if transported to the Orkneys. The county of Caithness, though chiefly mountainous, flattens towards the sea-coast, where the ground is arable, and produces good harvests of oats and barley, sufficient for the natives, and yielding a surplus for exportation. Caithness is well watered with small rivers, brooks, lakes, and fountains, and affords a few woods of birch, but is in general bare of trees; and even those the inhabitants plant are stunted in their growth. Lead is found at Dunnet, copper at Old Urk, and iron ore at several places; but these advantages are not improved. The air of Caithness is temperate, tho' in the latitude of 58, where the longest day in summer is computed at 18 hours; and when the sun sets, he makes so small an arch of a circle below the horizon, that the people enjoy a twilight until he rises again. The fuel used by the inhabitants of Caithness consists of peat and turf, which the ground yields in great plenty. The

forests

forefts of Moravius and Berridale afford abundance of red-deer and roe-bucks: the country is well ftored with hares, rabbits, growfe, heathcocks, plover, and all forts of game, comprehending a bird called *fnow-fleet*, about the fize of a fparrow, exceedingly fat and delicious, that comes hither in large flights about the middle of February, and takes its departure in April. The hills are covered with fheep and black cattle; fo numerous, that a fat cow has been fold at market for 4s. fterling. The rocks along the coafts are frequented by eagles, hawks, and all manner of fea-fowl, whofe eggs and young are taken in vaft quantities by the natives. The rivers and lakes abound with trout, falmon, and eels; and the fea affords a very advantageous fifhery. Divers obelifks and ancient monuments appear in this diftrict, and feveral Romifh chapels are ftill ftanding. Caithnefs is well peopled with a race of hardy inhabitants, who employ themfelves chiefly in fifhing, and breeding fheep and black cattle: they are even remarkably induftrious; for between Wick and Dunbeath, one continued track of rugged rocks, extending 12 miles, they have forced feveral little harbours for their fifhing boats, and cut artificial fteps from the beach to the top of the rocks, where they have erected houfes, in which they cure and dry the fifh for market.

According to Mr Pennant, this county is fuppofed to fend out in fome years about 20,000 head of black cattle, but in bad feafons the farmer kills and falts great numbers for fale. Great numbers of fwine are alfo reared here. Thefe are fhort, high-backed, long briftled, fharp, flender, and long-nofed; have long erect ears, and moft favage looks. Here are neither barns nor granaries: the corn is threfhed out, and preferved in the chaff in byks; which are ftacks, in the fhape of bee-hives, thatched quite round, where it will keep good for two years. Vaft numbers of falmon are taken at Caftle-hill, Dunnet, Wick, and Thurfo. A miraculous draught at this laft place is ftill talked of, not lefs than 2500 being taken at one tide within the memory of man; and Mr Smollet informs us, that, in the neighbourhood, above 300 good falmon have been taken at one draught of the net. In the month of November, great numbers of feals are taken in the caverns that open into the fea, and run fome hundreds of yards under ground. The entrance of thefe caverns is narrow, but the infide lofty and fpacious. The feal-hunters enter thefe in fmall boats with torches, which they light as foon as they land, and then with louds fhouts alarm the animals, which they kill with clubs as they attempt to pafs. This is a hazardous employment; for fhould the wind blow hard from fea, thefe adventurers are inevitably loft. Sometimes a large fpecies of feals, 12 feet long, have been killed on this coaft; and it is faid the fame kind are found on the rock Hifkir, one of the weftern iflands. During the fpring, great quantities of lump-fifh refort to this coaft, and are the prey of the feals, as appears from the number of fkins of thofe fifhes which at that feafon float afhore. At certain times alfo the feals feem to be vifited by a great mortality; for, at thofe times, multitudes of them are feen dead in the water. Much limeftone is found in this country, which when burnt is made into a compoft with turf and fea-plants. The common people are kept in great fervitude, and moft of their time is given to the lairds, an invincible impediment to the profperity of the country. The women are alfo condemned to a fhameful drudgery; it not being uncommon to fee them trudging in droves of 60 or 70 to the fields with bafkets of dung on their backs, which are filled at pleafure from the dunghills by their lords and mafters with their pitchforks.

The laft private war in Scotland was occafioned by a difpute relating to this county. An earl of Breadalbane married an heirefs of Caithnefs: the inhabitants would not admit her title, but fet up another perfon in oppofition. The earl, according to the cuftom of thofe times, defigned to affert his right by force of arms: he raifed an army of 1500 men; but thinking the number too great, he difmiffed firft one 500, and then another. With the remainder he marched to the borders of Caithnefs. Here he thought proper to add ftratagem to force. He knew that the enemy's army waited for him on the other fide of the promontory of Ord. He knew alfo, that whifky was then the nectar of Caithnefs; and therefore ordered a fhip laden with that precious liquor to pafs round, and wilfully ftrand itfelf on the fhore. The directions were punctually obeyed; and the crew in a feeming fright efcaped in the boats to the invading army. The Caithnefs men made a prize of the fhip; but making too free with the freight, became an eafy prey to the earl, who attacked them during their intoxication, and gained the county, which he difpofed of very foon after his conqueft.



CAIUS, Kaye, or *Keye*, (Dr John), the founder of Caius college in Cambridge, was born at Norwich in 1510. He was admitted very young a ftudent in Gonville-hall in the abovementioned univerfity; and at the age of 21 tranflated from Greek into Latin fome pieces of divinity, and into Englifh Erafmus's paraphrafe on Jude, &c. From thefe his juvenile labours, it feems probable that he firft intended to profecute the ftudy of divinity. Be that as it may, he travelled to Italy, and at Padua ftudied phyfic under the celebrated Montanus. In that univerfity he continued fome time, where we are told he read Greek lectures with great applaufe. In 1543, he travelled through part of Italy, Germany, and France; and returning to England commenced doctor of phyfic at Cambridge. He practifed firft at Shrewfbury, and afterwards at Norwich: but removing to London, in 1547 he was admitted fellow of the college of phyficians, to which he was feveral years prefident. In 1557, being then phyfician to queen Mary, and in great favour, he obtained a licence to advance Gonville-hall, where he had been educated, into a college; which he endowed with feveral confiderable eftates, adding an entire new fquare at the expence of 1834l. Of this college he accepted the mafterfhip, which he kept till within a fhort time of his death. He was phyfician to Edward VI. queen Mary, and queen Elizabeth. Towards the latter end of his life he retired to his own college at Cambridge; where, having refigned the mafterfhip to Dr Legge of Norwich, he fpent the remainder of his life as a fellow-commoner. He died in July 1573, aged 63; and was buried in the chapel of his own college. Dr Caius was a learned, active, benevolent man. In 1557, he erected a monument in St Paul's to the memory of the famous Linacre. In 1563, he obtained a grant for the college of phyficians to take the bodies of two malefactors

factors annually for dissection; and he was the inventor of the *insignia* which distinguish the president from the rest of the fellows. He wrote, 1. Annals of the college from 1555 to 1572. 2. Translation of several of Galen's works. Printed at different times abroad. 3. *Hippocrates de Medicamentis*, first discovered and published by our author; also *De ratione victus*, Lov. 1556, 8vo. 4. *De medendi Methodo*. Basil, 1544, Lond. 1555, 8vo. 5. Account of the sweating sickness in England. Lond. 1556. 1721. It is entitled *De ephemera Britannica*. 6. History of the university of Cambridge. Lond. 1568, 8vo. 1574, 4to. in Latin. 7. *De thermis Britannicis*, Doubtful whether ever printed. 8. Of some rare plants and animals. Lond. 1570. 9. *De cannibus Britannicis*, 1570. 1729. 10. *De pronunciatione Græcæ et Latinæ Linguæ*. Lond. 1554. 11. *De libris propriis*. Lond. 1570. Besides many other works which never were printed.

CAKE, a finer sort of bread, denominated from its flat round figure.

We meet with different compositions under the name of *cakes*; as *seed-cakes*, made of flour, butter, cream, sugar, coriander, and caraway seeds, mace, and other spices and perfumes baked in the oven; *plum-cake*, made much after the same manner, only with fewer seeds, and the addition of currants; *pan-cakes*, made of a mixture of flower, eggs, &c. fried; *cheese-cakes*, made of cream, eggs, and flour, with or without cheese-curd, butter, almonds, &c. *oat-cakes*, made of fine oaten flour, mixed with yest and sometimes without, rolled thin, and laid on an iron or stone to bake over a slow fire; *sugar-cakes*, made of fine sugar beaten and searced with the finest flour, adding butter, rose-water, and spices; *rose-cakes, placentæ rosaceæ*, are leaves of roses dried and pressed into a mass, sold in the shops for epithems.

The Hebrews had several sorts of cakes, which they offered in the temple. They were made of the meal either of wheat or barley; they were kneaded sometimes with oil and sometimes with honey. Sometimes they only rubbed them over with oil when they were baked, or fried them with oil in a frying pan upon the fire. In the ceremony of Aaron's consecration, they sacrificed a calf and two rams, and offered unleavened bread, and cakes unleavened, tempered with oil, and wafers unleavened anointed with oil; the whole made of fine wheaten flour. Ex. xxix. 1, 2.

CAKET, a town of Asia, in Persia, in the province of Gurgistan, near Mount Caucasus. Its trade consists chiefly of silks. E. Long. 46. 15. N. Lat. 43. 32.

CALABASH, in commerce, a light kind of vessel formed of the shell of a gourd, emptied and dried, serving to put divers kinds of goods in, as pitch, rosin, and the like. The word is Spanish, *Calabacca*, which signifies the same. The Indians also, both of the North and South Sea, put the pearls they have fished in calabashes, and the negroes on the coast of Africa do the same by their gold-dust. The smaller calabashes are also frequently used by these people as a measure, by which they sell these precious commodities to the Europeans. The same vessels likewise serve for putting in liquors; and do the office of cups, as well as bottles, for soldiers, pilgrims, &c.

*Calabash-Tree*, in botany. See Crescentia.

*African Calabash-Tree*. See Adansonia.

CALABRIA, a country of Italy, in the kingdom of Naples, divided into Calabria Ultra, and Calabria Citra, commonly called *Ulterior* and *Citerior*, or Farther and Hither Calabria. Calabria Citerior is one of the 12 provinces of the kingdom of Naples; and bounded on the south by Calabria Ultra, on the north by Basilicata, and on the west and east by the sea: Cosensa is the capital. Calabria Ultra is washed by the Mediterranean sea on the east, south, and west, and bounded by Calabria Citra on the north. Reggio is the capital town.



This country has been almost entirely desolated by the earthquakes of 1783. The reiterated shocks extended from Cape Spartivento to Amantea above the gulf of St Eufemia, and also affected that part of Sicily which lies opposite to the southern extremity of Italy. Those of the 5th and 7th of February, and of the 28th of March, were the most violent, and completed the destruction of every building throughout the abovementioned space. Not one stone was left upon another south of the narrow isthmus of Squillace; and what is more disastrous, a very large proportion of the inhabitants was killed by the falling of their houses, near 40,000 lives being lost. Some persons were dug out alive after remaining a surprising length of time buried among the rubbish. Messina became a mass of ruins; its beautiful Palazzata was thrown in upon the town, and its quay cracked into ditches full of water. Reggio almost destroyed; Tropea greatly damaged; every other place in the province levelled to the ground.

Before and during the concussion the clouds gathered, and then hung immoveable and heavy over the earth. At Palmi, the atmosphere wore so fiery an aspect, that many people thought part of the town was burning. It was afterwards remembered that an unusual heat had affected the skin of several persons just before the shock; the rivers assumed a muddy ash-coloured tinge, and a sulphureous smell was almost general. A frigate passing between Calabria and Lipari felt so severe a shock, that the steersman was thrown from the helm, and the cannons were raised upon their carriages, while all around the sea exhaled a strong smell of brimstone.

Stupendous alterations were occasioned in the face of the country; rivers ckoaked up by the falling in of the hills, were converted into lakes, which if not speedily drained, by some future convulsion, or opened by human labour, will fill the air with pestilential vapours, and destroy the remnants of population. Whole acres of ground, with houses and trees upon them, were broken off from the plains, and washed many furlongs down the deep hollows which the course of the rivers had worn; there, to the astonishment and terror of beholders, they found a new foundation to fix upon, either in an upright or an inclining position. In short, every species of phenomenon, incident to these destructive commotions of the earth, was to be seen in its utmost extent and variety in this ruinated country. Their Sicilian majesties, with the utmost expedition, dispatched vessels loaded with every thing that could be thought of on the occasion for the relief and accommodation of the distressed Calabrians; a general officer went from Naples with engineers and troops to direct the operations of the persons employed in clearing away and rebuilding the houses, and to defend the property of the sufferers. The king ordered this officer to take all the money the royal treasures could supply or borrow; for, rather than it should be wanting on this pressing call, he was determined to part with his plate, nay, the very furniture of his palace. A messenger sent off from a town near Reggio on the 8th of February, travelled four days without shelter, and without being able to procure a morsel of bread; he supported nature with a piece of cheese which he had brought in his pocket, and the vegetables he was lucky enough to find near the road. To add to all their other sufferings, the Calabrians found themselves and the miserable wreck of their fortunes exposed to the depredations of robbers and pirates. Villains landed from boats and plundered several places, and thieves went even from Naples in search of booty: In order to strike a greater terror, they dressed themselves like Algerines; but were discovered and driven off. To this accumulated distress succeeded a most inclement season, which obstructed every effort made to alleviate it; and almost daily earthquakes kept the inhabitants in continual dread, not of being destroyed by the fall of houses, for none were left, but of being swallowed up by the splitting of the earth, or buried in the waves by some sudden inundation.

For further particulars concerning this dreadful catastrophe, and the phenomena attending it, see EARTHQUAKE.

CALADE, in the manege, the descent or sloping declivity of a rising manege-ground, being a small eminence, upon which we ride down a horse several times, putting him to a short gallop, with his fore-hams in the air, to learn him to ply or bend his haunches, and form his stop upon the aids of the calves of the legs, the stay of the bridle, and the caveson seasonably given.

CALAGORINA, or CALAGURIS, distinguished by the surname *Nasica* (anc. geog.), a city of the Vascones in the Hither Spain; now *Calahorra*.

CALAHORRA, an episcopal town of Spain, in Old Castile, seated in a fertile soil, on the side of a hill which extends to the banks of the river Ebro, W. Long. 2. 7. N. Lat. 42. 12.

CALAIS, a strong town of France, in Lower Picardy, with a citadel and a fortified harbour. It is built in the form of a triangle, one side of which is towards the sea. The citadel is as large as the town, and has but one entrance. It is a trading place, with handsome streets, and several churches and monasteries; the number of inhabitants is reckoned to be 4000.

Calais was taken by Edward III. in 1347. Hither he marched his victorious army from Crescy, and invested the town on the 8th of September. But finding that it could not be taken by force without the destruction of great multitudes of his men, he turned the siege into a blockade, and having made strong entrenchments to secure his army from the enemy, huts to protect them from the inclemency of the weather, and stationed a fleet before the harbour to prevent the introduction of provisions, he resolved to wait with patience till the place fell into his hands by famine. The besieged, discovering his intention, turned seventeen hundred women, children, and old people out of the town, to save their provisions; and Edward had the goodness, after entertaining them with a dinner, and giving them twopence a-piece, to suffer them to pass. The garrison and inhabitants of Calais having at length consumed all their provisions, and even eaten all their horses, dogs, cats, and vermin, in the place, the governor John de Vienne appeared upon the walls, and offered to capitulate. Edward, greatly incensed at their obstinate resistance, which had detained him eleven months under their walls, at an immense expence both of men and money, sent Sir Walter Manny, an illustrious knight, to acquaint the governor, that he would grant them no terms; but that they must surrender at discretion. At length, however, at the spirited remonstrances of the governor, and the persuasions of Sir Walter Manny, Edward consented to grant their lives to all the garrison and inhabitants, except six of the principal burgesses, who should deliver to him the keys of the city, with ropes about their necks. When these terms were made known to the people of Calais, they were plunged into the deepest distress; and after all the miseries they had suffered, they could not think without horror of giving up six of their fellow-citizens to certain death. In this extremity, when the whole people were drowned in tears, and uncertain what to do, Eustace de Pierre, one of the richest merchants in the place, stepped forth, and voluntarily offered himself to be one of these six devoted victims. His noble example was soon imitated by other five of the most wealthy citizens. These true patriots, barefooted, and bareheaded, with ropes about their necks, were attended to the gates by the whole inhabitants, with tears, blessings, and prayers, for their safety. When they were brought into Edward's presence, they laid the keys of the city at his feet, and falling on their knees implored his mercy in such moving strains, that all the noble spectators melted into tears. The king's resentment was so strong for the many toils and losses he had suffered in this tedious siege, that he was in some danger of forgetting his usual humanity; when the queen, falling upon her knees before him, earnestly begged and obtained their lives. This great and good princess conducted these virtuous citizens, whose lives she had saved, to her own apartment, entertained them honourably, and dismissed them with presents. Edward took possession of Calais August 4th; and in order to secure a conquest of so great importance, and which had cost him so dear, he found it necessary to turn out all the ancient inhabitants, who had discovered so strong an attachment to their native prince, and to people it with English.

Calais remained in subjection to England till the reign of queen Mary, when it was retaken by the duke of Guise. This general began the enterprise by ordering the privateers of Normandy and Bretagne to cruize in the channel, more especially in the very straits of Calais; he then detached the duke of Nevers, with a considerable army, towards the country of Luxemburgh; a motion which drew the attention of the Spaniards that way: when all things were ready, he procured an application from the people Boulogne, for a body of troops to secure them against the incursions of the Spaniards; he sent a strong detachment at their request, which was followed by another, under colour of supporting them, then repaired thither in person, secure that his officers would follow his instructions; and thus, on the first day of the new year, 1557, Calais was invested. He immediately attacked

tacked fort St Agatha, which the garrifon quitted, and retired into the fort of Nieulai, which, together with the Rifbank, the befiegers attacked at the fame time, granted good terms to the officer who commanded in the former, but obliged the garrifon of the latter to furrender prifoners of war. By thefe means he opened a communication with the fea; and having received from on board the fhips an immenfe quantity of hurdles, his infantry, by the help of them, paffed the moraffes that lie round the town. He then made a falfe attack at the water-gate, which drew the attention of the garrifon, who fatigued themfelves exceedingly in making entrenchments behind the breach; but when they had finifhed their work, he began to fire upon the caftle, where the walls were very old, and had been neglected on account of the breadth of the ditch, which was alfo very deep when the tide was in; but a great breach being made, the duke caufed it to be attacked in the night, and during the ebb the foldiers paffing almoft up to the fhoulders. The place was eafily carried, though the governor made three vigorous attacks before the break of day, in order to diflodge them; but the French, though they loft a confiderable number of men, kept their pofts. The governor then faw that it was impracticable to defend the place any longer, and therefore made the beft terms for himfelf that he could obtain, which, however, were not very good: and thus in eight days the duke of Guife recovered a fortrefs which coft the victorious Edward III. a whole year's fiege, and which had been now 210 years in the poffeffion of the Englifh, without fo much as a fingle attempt to retake it. There are very different accounts given of this matter: Some Englifh hiftorians fay, that king Philip penetrated the defign of the French upon this fortrefs, gave notice of it in England, and offered to take the defence of it upon himfelf; but that this, out of jealoufy, was refufed, it being believed to be only an artifice to get a place of fuch confequence into his own hands. The truth of the matter feems to be this: The ftrength of Calais confifted in its fituation and outworks, which required a very numerous garrifon; but this being attended with a very large expence, the beft part of the troops had been fent to join Philip's army, fo that the governor had not above 500 men, and there were not more than 250 of the townfmen able to bear arms. As to ammunition, artillery, and provifions, the French found there abundance, but with fo flender a garrifon, that it was impoffible to make a better defence; and therefore, when the lord Wentworth, who was governor, and whom the French call lord Dumfort, was tried by his peers for the lofs of this place, he was acquitted. The duke obliged all the Englifh inhabitants to quit Calais; and beftowed the government of it upon des Termes, who was foon after made a marfhal of France.

The fortifications of Calais are good; but its greateft ftrength is its fituation among the marfhes, which may be overflowed at the approach of an enemy. The harbour is not fo good as formerly, nor will it admit veffels of any great burden. In times of peace, there are packet-boats going backward and forward twice a week from Dover to Calais, which is 21 miles diftant. E. Long. 2. 6. N. Lat. 50. 58.

*Calais and Zetes*, in fabulous hiftory, fons of Boreas and Orythia, to whom the poets attributed wings: they went on the voyage of Colchis with the Argonauts, delivered Phineus from the harpies, and were flain by Hercules.



CALAMANCO, a fort of woollen ftuff manufactured in England and Brabant. It has a fine glofs; and is checkered in the warp, whence the checks appear only on the right fide. Some calamancos are quite plain, others have broad ftripes adorned with flowers, fome with plain broad ftripes, fome with narrow ftripes, and others watered.

CALAMARIÆ, in botany, an order of plants in the *Fragmenta methodi naturalis* of Linnæus; in which he has the following genera, viz. bobartia, fcirpus, cyperus, eriophorum, carex, fchænus, flagellaria, juncus. See BOTANY.

CALAMATA, a confiderable town of Turkey in Europe, in the Morea, and province of Belvedera. It was taken by the Venetians in 1685; but the Turks retook it afterwards with all the Morea. It ftands on the river Spinarza, eight miles from the fea. E. Long. 22. 15. N. Lat. 37. 8.

CALAMINE CALAMY, *Lapis Calaminaris*, or *Cadmia Foffilis*, a fort of ftone or mineral, containing zinc, iron, and fometimes other fubftances. It is confiderably heavy, and the more fo the better; moderately hard and brittle, or of a confiftence betwixt ftone and earth: the colour is fometimes whitifh or grey; fometimes yellowifh, or of a deep yellow; fometimes red; fometimes brown or blackifh. It is plentiful in feveral places of Europe, as Hungary, Tranfylvania, Poland, Spain, Sweden, Bohemia, Saxony, Goflar, France, and England, particularly in Derbyfhire, Gloucefterfhire, Nottinghamfhire, and Somerfetfhire, as alfo in Wales. The calamine of England, however, is by the beft judges allowed to be fuperior in quality to that of moft other countries. It feldom lies very deep, being chiefly found in clayey grounds near the furface. In fome places it is mixed with lead-ores. It is the only true ore of zinc, and is ufed as an ingredient in making of brafs.—Newmann relates various experiments with this mineral, the only refult of which was to fhow that it contained iron as well as zinc. The moft remarkable are the following. A faturated folution of calamine in the marine acid, concentrated by evaporating part of the liquor, exhibits in the cold an appearance of fine cryftals, which on the application of warmth diffolve and difappear. A little of this concentrated folution tinges a large quantity of water of a bright yellow colour; and at the fame time depofits by degrees a fine, fpongy, brownifh precipitate. Glue diffolved in this folution, and afterwards infpiffated, forms an extremely flippery tenacious mafs, which does not become dry, and, were it not too expenfive, might be of ufe for entangling flies, caterpillars, &c. Sulphur boiled in the folution feems to acquire fome degree of tranfparency.—This mineral is an article in the materia medica; but, before it comes to the fhops is ufually roafted or calcined, in order to feparate fome arfenical or fulphureous matter which in its crude ftate it is fuppofed to contain, and to render it more eafily reducible into a fine powder. In this ftate it is employed in collyria againft defluxions of thin acrid humours upon the eyes, for drying up moift running ulcers, and healing excoriations. It is the bafis of an officinal epulotic CERATE.

Though the lapis calaminaris is the only native ore of zinc, there is another substance from which that semi-metal is also obtained. This is called *cadmia fornacum*, or *cadmia of the furnaces*, to distinguish it from the other. This is a matter sublimed when ores containing zinc, like those of Rammelsberg, are smelted. This cadmia consists of the flowers of the semi-metal sublimed during the fusion, and adhering to the inner surfaces of the walls of furnaces, where they suffer a semi-fusion, and therefore acquire some solidity. So great a quantity of these are collected, that they form very thick incrustations, which must be frequently taken off. The name of *cadmia of the furnaces* has also been given to all the soots and metallic sublimates formed by smelting in the great, although there is certainly a difference in these matters.

CALAMINT, in botany. See MELISSA, and MENTHA.

CALAMUS, in botany: A genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the 5th order, *Tripetaloideæ*. The calyx is hexaphyllous, there is no corolla, the fruit is a dry monospermous berry, imbricated backwards. There is but one species, the rotang. The stem is without branches, has a crown at top, and is every where beset with straight spines. This is the true Indian cane, which is not visible on the outside; but the bark being taken off discovers the smooth stick, which has no marks of spine on the bark, and is exactly like those which the Dutch sell to us; keeping this matter very secret, lest travellers going by should take as many canes out of the woods as they please. Sumatra is said to be the place where most of these sticks grow. Such are to be chosen as are of proper growth between two joints, suitable to the fashionable length of canes as they are then worn: but such are scarce.—The calamus rotang is one of several plants from which the drug called Dragon's-blood is obtained.

CALAMUS, in the ancient poets, denotes a simple kind of pipe or fistula, the musical instrument of the shepherds and herdsmen; usually made either of an oaten stalk or a reed.

CALAMUS *Aromaticus*, or *Sweet-scented Flag*, in the materia medica, a species of flag called *acorus* by Linnæus. See ACORUS.

CALAMUS *Scriptorius*, in antiquity, a reed or rush to write with. The ancients made use of styles to write on tables covered with wax; and of reed, or rush, to write on parchment, or Egyptian paper.

CALAMY (Edmund), an eminent Presbyterian divine, born at London in the year 1600, and educated at Pembroke-hall, Cambridge, where his attachment to the Arminian party excluded him from a fellowship. Dr Felton bishop of Ely, however, made him his chaplain; and, in 1639, he was chosen minister of St Mary Aldermary, in the city of London. Upon the opening of the long parliament, he distinguished himself in defence of the Presbyterian cause; and had a principal hand in writing the famous *Smectymnus*, which, himself says, gave the first deadly blow to episcopacy. The authors of this tract were five, the initials of whose names formed the name under which it was published; viz. Stephen Marshal, Edmund Calamy, Thomas Young, Matthew Newcomen, and William Sparstow. He was after that an active member in the assembly of divines, was a strenuous opposer of sectaries, and used his utmost endeavours to prevent those violences committed after the king was brought from the isle of Wight. In Cromwell's time he lived privately, but was assiduous in promoting the king's return; for which he was afterwards offered a bishopric, but refused it. He was ejected for nonconformity in 1662; and died of grief at the sight of the great fire of London.

CALAMY (Edmund), grandson to the preceding (by his eldest son Mr Edward Calamy, who was ejected out of the living of Moxton in Essex on St Bartholomew's day 1662), was born in London, April 5th 1671. After having learned the languages, and gone through a course of natural philosophy and logic at a private academy in England, he studied philosophy and civil law at the university of Utrecht, and attended the lectures of the learned Grævius. Whilst he resided here, an offer of a professor's chair in the university of Edinburgh was made him by Mr Carstairs, principal of that university, sent over on purpose to find a person properly qualified for such an office. This he declined; and returned to England in 1691, bringing with him letters from Grævius to Dr Pocock canon of Christchurch and regius professor of Hebrew, and to Dr Bernard Savilian professor of astronomy, who obtained leave for him to prosecute his studies in the Bodleian library. Having resolved to make divinity his principal study, he entered into an examination of the controversy between the conformists and non-conformists; which determined him to join the latter: and coming to London in 1692, he was unanimously chosen assistant to Mr Matthew Sylvester at Blackfriars; and in 1694, he was ordained at Mr Annesly's meeting-house in Little St-Helena, and soon after was invited to become assistant to Mr Daniel Williams in Hand-Alley. In 1702, he was chosen to be one of the lecturers in Salter's-hall; and, in 1703, succeeded Mr Vincent Alsop as pastor of a great congregation in Westminster. He drew up the table of contents to Mr Baxter's history of his life and times, which was sent to the press in 1696; made some remarks on the work itself, and added to it an index; and, reflecting on the usefulness of the book, he saw the expediency of continuing it, for Mr Baxter's history came no lower than the year 1684. Accordingly he composed an abridgement of it, with an account of many other ministers who were ejected after the restoration of Charles II.; their apology, containing the grounds of their nonconformity and practice as to stated and occasional communion with the church of England; and a continuation of their history till the year 1691. This work was published in 1702. He afterwards published a moderate defence of nonconformity, in three tracts, in answer to some tracts of Dr Hoadley. In 1709, Mr Calamy made a tour to Scotland; and had the degree of doctor of divinity conferred on him by the universities of Edinburgh, Aberdeen, and Glasgow. In 1713, he published a second edition of his Abridgement of Mr Baxter's history of his life and times; in which, among other additions, there is a continuation of the history through king William's reign, and queen Anne's, down to the passing of the occasional bill; and in the close is subjoined the reformed liturgy, which was drawn

drawn up and presented to the bishops in 1661, "that the world may judge (he says in his preface) how fairly the ejected ministers have been often represented as irreconcileable enemies to all liturgies." In 1718, he wrote a vindication of his grandfather, and several other persons, against certain reflections cast upon them by Mr Archdeacon Echard in his History of England; and in 1728 appeared his Continuation of the account of the ministers, lecturers, masters, and fellows of colleges, and schoolmasters, who were ejected, after the restoration in 1660, by or before the act of uniformity. He died June 3d 1732, greatly regretted, not only by the dissenters, but also by the moderate members of the established church, both clergy and laity, with many of whom he lived in great intimacy. Besides the pieces already mentioned, he published a great many sermons on several subjects and occasions. He was twice married, and had 13 children.

CALANDRE, a name given by the French writers to an insect that does vast mischief in granaries. It is properly of the scarab or beetle-class; it has two antennæ or horns formed of a great number of round joints, and covered with a soft and short down; from the anterior part of the head there is thrust out a trunk, which is so formed at the end, that the creature easily makes way with it through the coat or skin that covers the grain, and gets at the meal or farina on which it feeds; the inside of the grains is also the place where the female deposits her eggs, that the young progeny may be born with provision about them. When the female has pierced a grain of corn for this purpose, she deposits in it one egg, or at the utmost two, but she most frequently lays them single: these eggs hatch into small worms, which are usually found with their bodies rolled up in a spiral form, and after eating till they arrive at their full growth, they are changed into chrysales, and from these in about a fortnight comes out the perfect calandre. The female lays a considerable number of eggs; and the increase of these creatures would be very great: but nature has so ordered it, that while in the egg state, and even while in that of the worm, they are subject to be eaten by mites; these little vermin are always very plentiful in granaries, and they destroy the far greater number of these larger animals.

CALAS, (John) the name of a most unfortunate Protestant merchant at Thoulouse, inhumanly butchered under forms of law cruelly prostituted to shelter the sanguinary dictates of ignorant Popish zeal. He had lived 40 years at Thoulouse. His wife was an English woman of French extraction: and they had five sons; one of whom, Lewis, had turned Catholic through the persuasion of a Catholic maid who had lived 30 years in the family. In October 1761, the family consisted of Calas, his wife, Mark Anthony their son, Peter their second son, and this maid. Anthony was educated for the bar; but being of a melancholy turn of mind, was continually dwelling on passages from authors on the subject of suicide, and one night in that month hanged himself on a bar laid across two folding doors in their shop. The crowd collected by the confusion of the family on so shocking a discovery, took it into their heads that he had been strangled by the family to prevent his changing his religion, and that this was a common practice among protestants. The officers of justice adopted the popular tale, and were supplied by the mob with what they accepted as evidences of the fact. The fraternity of white penitents got the body, buried it with great ceremony, and performed a solemn service for him as a martyr; the Franciscans did the same: and after these formalities no one doubted the guilt of the devoted heretical family. They were all condemned to the torture, to bring them to confession: they appealed to the parliament; who, as weak and as wicked as the subordinate magistrates, sentenced the father to the torture ordinary and extraordinary, to be broken alive upon the wheel, and then to be burned to ashes. A diabolical decree! which, to the shame of humanity, was actually carried into execution. Peter Calas, the other son, was banished for life; and the rest were acquitted. The distracted widow found some friends, and among the rest M. Voltaire, who laid her case before the council of state at Versailles, and the parliament of Thoulouse were ordered to transmit the proceedings. These the king and council unanimously agreed to annul; the capitoul, or chief magistrate of Thoulouse, was degraded and fined; old Calas was declared to have been innocent; and every imputation of guilt was removed from the family, who also received from the king and clergy considerable gratuities.



CALASH, or CALESH, a small light kind of chariot or chair, with very low wheels, used chiefly for taking the air in parks and gardens. The calash is for the most part richly decorated, and open on all sides for the conveniency of the air and prospect, or at most inclosed with light mantlets of wax-cloth to be opened and shut at pleasure. In the Philosophical Transactions we have a description of a new sort of calash going on two wheels, not hung on traces, yet easier than the common coaches, over which it has this further advantage, that whereas a common coach will overturn if one wheel go on a surface a foot and an half higher than the other, this will admit of a difference of $3\frac{1}{2}$ feet without danger of overturning. Add, that it would turn over and over; that is, after the spokes being so turned as that they are parallel to the horizon, and one wheel flat over the head of him that rides in it, and the other flat under him, it will turn once more, by which the wheels are placed *in statu quo*, without any disorder to the horse or rider.

CALASIO (Marius), a Franciscan, and professor of the Hebrew language at Rome, of whom there is very little to be said, but that he published there, in the year 1621, a Concordance of the Bible, which consisted of four great volumes in folio. This work has been highly approved and commended both by Protestants and Papists, and is indeed a most admirable work. For besides the Hebrew words in the Bible, which are in the body of the book with the Latin version over against them; there are, in the margin, the differences between the septuagint version and the vulgate; so that at one view may be seen wherein the three Bibles agree, and wherein they differ. Moreover, at the beginning of every article there is a kind of dictionary, which gives the signification of each Hebrew word; affords an opportunity of comparing it with other oriental languages, viz. with the Syriac, Arabic, and Chaldee; and is extremely useful for determining more exactly the true meaning of the Hebrew words.

CALASIRIS, in antiquity, a linen tunic fringed at the bottom, and worn by the Egyptians under a white woollen garment; but this last they were obliged to pull off when they entered the temples, being only allowed to appear there in linen garments.

CALATAJUD, a large and handsome town of Spain, in the kingdom of Arragon; situated at the confluence of the rivers Xalon and Xiloca, at the end of a very fertile valley, with a good castle on a rock. W. Long. 2. 9. N. Lat. 41. 22.

CALATHUS, in antiquity, a kind of hand-basket made of light wood or rushes; used by the women sometimes to gather flowers, but chiefly after the example of Minerva, to put their work in. The figure of the calathus, as represented on ancient monuments, is narrow at the bottom, and widening upwards like that of a top. Pliny compares it to that of a lily. The calathus or work-basket of Minerva is no less celebrated among the poets than her distaff.

CALATHUS was also the name of a cup for wine used in sacrifices.

CALATOR, in antiquity, a cryer or officer appointed to publish something aloud, or call the people together. The word is formed from καλεω, *voco, I call.* Such ministers the pontifices had, whom they used to send before them when they went to sacrifice on *feriæ* or holidays, to advertise the people to leave off work. The magistrates also used *calatores*; to call the people to the comitia, both *curiata* and *centuriata*. The officers in the army also had *calatores*; as had likewise many private families, to invite their guests to entertainments.

CALATRAVA, a city of New Castile, in Spain, situated on the river Guadiana, 45 miles south of Toledo. W. Long. 4. 20. N. Lat. 39. 0.

*Knights of* CALATRAVA, a military order in Spain, instituted under Sancho III. king of Castile, upon the following occasion. When that prince took the strong fort of Calatrava from the moors of Andalusia, he gave it to the templars, who, wanting courage to defend it, returned it him again. Then Don Reymond, of the order of the Cistercians, accompanied with several persons of quality, made an offer to defend the place, which the king thereupon delivered up to them, and instituted that order. It increased so much under the reign of Alphonsus, that the knights desired they might have a grand master, which was granted. Ferdinand and Isabella afterwards, with the consent of pope Innocent VIII. re-united the grand mastership of Calatrava to the Spanish crown; so that the kings of Spain are now become perpetual administrators thereof

The knights of Calatrava bear a cross gules, flowerdelised with green, &c. Their rule and habit was originally that of the Cistercians.

CALAURIA, (anc. geog) an island of Greece in the Saronic bay, over against the port of Troezen, at the distance of 40 stadia. Hither Demosthenes went twice into banishment; and here he died. Neptune was said to have accepted this island from Apollo, in exchange for Delos. The city stood on a high ridge nearly in the middle of the island, commanding an extensive view of the gulph and its coasts. There was his holy temple. The priestess was a virgin, who was dismissed when marriageable. Seven of the cities near the island held a congress at it, and sacrificed jointly to the deity. Athens, Ægina, and Epidaurus were of this number, with Nauplia, for which place Argos contributed. The Macedonians, when they had reduced Greece, were afraid to violate the sanctuary, by forcing from it the fugitives, his suppliants. Antipater commanded his general to bring away the orators who had offended him, alive; but Demosthenes could not be prevailed on to surrender. His monument remained in the second century, within the inclosure of the temple. The city of Calauria has been long abandoned. Traces of buildings, and of ancient walls, appear nearly level with the ground; and some stones, in their places, each with a seat and back, forming a little circle, once perhaps a bath. The temple, which was of the Doric order, and not large, as may be inferred from the fragments, is reduced to an inconsiderable heap of ruins. The island is now called *Poro*. It stretches along before the coast of the Morea in a lower ridge, and is separated from it by a canal only four stadia or half a mile wide. This, which is called Poro or the Ferry, in still weather may be passed on foot, as the water is not deep. It has given its name to the island, and also to the town, which consists of of about 200 houses, mean and low, with flat roofs; rising on the slope of a bare disagreeable rock.



CALCADA, or *St Dimingo* CALCALDA, a town of Spain, situated in W. Long. 3. 5. N. Lat. 42. 36.

CALCAR, a very strong town of Germany, in the circle of Westphalia, and duchy of Cleves. It belongs to the king of Prussia, and is seated near the Rhine, in E. Long. 5. 41. N. Lat. 51. 45.

CALCAR, in glass-making, the name of a small oven, or reverberatory furnace, in which the first calcination of sand and salt of potashes is made for the turning them into what is called *frit*. This furnace is made in the fashion of an oven ten feet long, seven broad in the widest part, and two feet deep. On one side of it is a trench six inches square, the upper part of which is level with the calcar, and separated only from it at the mouth by bricks nine inches wide. Into this trench they put sea-coal, the flame of which is carried into every part of the furnace, and is reverberated from the roof upon the frit, over the surface of which the smoke flies very black, and goes out at the mouth of the calcar; the coals burn on iron grates, and the ashes fall through.

CALCAR (John de), a celebrated painter, was the disciple of Titian, and perfected himself by studying Raphael. Among other pieces he drew a nativity, representing the angels around the infant Christ; and so ordered the disposition of his picture, that the light all proceeds from the child. He died at Naples, in 1546, in the flower of his age. It was he who designed the anatomical figures of Vesal, and the portraits of the painters of Vesari.

CALCAREOUS, something that partakes of the nature and qualities of CALX, or lime. We say, a *calcareous* earth, *calcareous* stone. See CHEMISTRY-*Index*.

CALCEARIUM, in antiquity, a donative or largess bestowed on Roman soldiers for buying shoes. In monasteries, *calcearium* denoted the daily service of cleaning the shoes of the religious.

CALCEOLARIA, in botany, a genus of the monogynia order, belonging to the diandria class of plants. The corolla is ringent and inflated; the capsule has two cells, and two valves; the calyx four parted and equal.

CALCHAS, in fabulous history, a famous diviner, followed the Greek army to Troy. He foretold that the siege would last ten years; and that the fleet, which was detained in the port of Aulis by contrary winds, would not sail till Agamemnon's daughter had been sacrificed to Diana. After the taking of Troy, he retired to Colophon; where, it is said, he died of grief, because he could not divine what another of his profession, called *Mopsus*, had discovered.

CALCINATION, in chemistry, the reducing of substances to a calx by fire. See *Chemistry-Index*.

CALCINATO, a town of Italy, in the duchy of Mantua, remarkable for a victory gained over the Imperialists by the French in 1706. E. Long. 9. 55. N. Lat. 45. 25.

CALCULARY *of a Pear*, a congeries of little strong knots dispersed through the whole parenchyma of the fruit. The calculary is most observed in roughtasted or choak-pears. The knots lie more continuous and compact together towards the pear where they surround the ACETARY. About the stalk they stand more distant; but towards the cork, or stool of the flower, they still grow closer, and there at last gather into the firmness of a plumb-stone. The calculary is no vital or essential part of the fruit; the several knots whereof it consists being only so many concretions or precipitations out of the sap, as we see in urines, wines, and other liquors.

CALCULATION, the act of computing several sums, by adding, subtracting, multiplying, or dividing. See ARITHMETIC.

CALCULATION is more particularly used to signify the computations in astronomy and geometry, for making tables of logarithms, ephemerides, finding the time of eclipses, &c. See ASTRONOMY, GEOMETRY, and LOGARITHMS.

CALCULUS, primarily denotes a little stone or pebble, anciently used in making computations, taking of suffrages, playing at tables, and the like. In aftertimes, pieces of ivory, and counters struck of silver, gold, and other matters, were used in lieu thereof, but still retaining the ancient names. Computists were by the lawyers called *calculones*, when they were either slaves or newly freed men; those of a better condition were named *calculatores* or *numerarii*: ordinarily there was one of these in each family of distinction. The Roman judges anciently gave their opinions by calculi, which were white for absolution, and black for condemnation. Hence *calculus albus*, in ancient writers, denotes a favourable vote, either in a person to be absolved and acquitted of a charge, or elected to some dignity or post; as *calculus niger* did the contrary. This usage is said to have been borrowed from the Thracians, who marked their happy or prosperous days by *white*, and their unhappy by *black*, pebbles, put each night into an urn.

Besides the diversity of colour, there were some calculi also which had figures or characters engraven on them, as those which were in use in taking the suffrages both in the senate and at assemblies of the people. These calculi were made of thin wood, polished and covered over with wax. Their form is still seen in some medals of the Cassian family; and the manner of casting them into the urns, in the medals of the Licinian family. The letters marked upon these calculi were U. R. for *uti rogas*, and A. for *antiquo*; the first of which expressed an approbation of the law, the latter a rejection of it. Afterwards the judges who sat in capital causes used calculi marked with the letter A. for *absolvo*; C. for *condemno*; and N. L. for *non liquet*, signifying that a more full information was required.

Calculus is also used in ancient grammatic writers for a kind of weight equal to two grains of cicer. Some make it equivalent to the siliqua, which is equal to three grains of barley. Two calculi made the ceratium.

CALCULUS *Differentialis* is a method of differencing quantities, or of finding an infinitely small quantity, which, being taken infinite times, shall be equal to a given quantity; or, it is the arithmetic of the infinitely small differences of variable quantities.

The foundation of this calculus is an infinitely small quantity, or an infinitesimal, which is a portion of a quantity incomparable to that quantity, or that is less than any assignable one, and therefore accounted as nothing; the error accruing by omitting it being less than any assignable one. Hence two quantities, only differing by an infinitesimal, are reputed equal. Thus, in Astronomy, the diameter of the earth is an infinitesimal, in respect of the distance of the fixed stars; and the same holds in abstract quantities. The term, infinitesimal, therefore, is merely respective, and involves a relation to another quantity; and does not denote any real ens, or being. Now infinitesimals are called *differentials*, or *differential quantities*, when they are considered as the differences of two quantities. Sir Isaac Newton calls them *moments*; considering them as the momentary increments of quantities, v. g. of a line generated by the flux of a point, or of a surface by the flux of a line. The differential calculus, therefore, and the doctrine of fluxions, are the same thing under different names; the former given by M. Leibnitz, and the latter by Sir Isaac Newton: each of whom lay claim to the discovery. There is, indeed, a difference in the manner of expressing the quantities resulting from the different views wherein the two authors consider the infinitesimals; the one as moments, the other as differences: Leibnitz, and most foreigners, express the differentials of quantities by the same letters as variable ones, only prefixing the letter $d$: thus the differential of $x$ is called $dx$; and that of $y$, $dy$: now $dx$ is a positive quantity, if $x$ continually increase; negative, if it decrease. The English, with Sir Isaac Newton, instead of $dx$ write $x$ (with a dot over it;) for $dy$, $y$, &c. which foreigners object against, on account of that confusion of points, which they imagine arises when differentials are again differenced; besides, that the printers are more apt to overlook a point than a letter. Stable quantities being always expressed by the first letters of the alphabet $da=o$, $db=o$, $dc=o$; wherefore $d(x+y-a)=dx+dy$, and $d(x-y+a)\ dx-dy$. So that the differencing of quantities is easily performed, by the addition or subtraction of their compounds.

To difference quantities that multiply each other; the rule is, first, multiply the differential of one factor into the other factor, the sum of the two factors is the differential sought: thus, the quantities being $xy$, the dif-

differential will be $x\,dy + y\,dx$, i. e. $d\,(xy) = x\,dy + y\,dx$. Secondly, if there be three quantities mutually multiplying each other, the factum of the two must then be multiplied into the differential of the third: thus suppose $vxy$, let $vx = t$, then $vxy = ty$; consequently $d\,(vxy) = t\,dy + y\,dt$: but $dt = v\,dx + x\,dv$. These values, therefore, being substituted in the antecedent differential, $t\,dy + y\,dt$, the result is, $d\,(vxy) = vx\,dy + vy\,dx + xy\,dv$. Hence it is easy to apprehend how to proceed, where the quantities are more than three. If one variable quantity increase, while the other $y$ decreases, it is evident $y\,dx - x\,dy$ will be the differential of $xy$.

To difference quantities that mutually divide each other; the rule is, first, multiply the differential of the divisor into the dividend; and on the contrary, the differential of the dividend into the divisor; subtract the last product from the first, and divide the remainder by the square of the divisor; the quotient is the differential of the quantities mutually dividing each other. See FLUXIONS.

*CALCULUS Exponentialis*, is a method of differencing exponential quantities, or of finding and summing up the differentials or moments of exponential quantities; or at least bringing them to geometrical constructions.

By exponential quantity, is here understood a power, whose exponent is variable; v. g. $x^x$ $a^x$ $x^y$. where the exponent $x$ does not denote the same in all the points of a curve, but in some stands for 2, in others for 3, in others for 5, &c.

To difference an exponential quantity; there is nothing required but to reduce the exponential quantities to logarithmic ones; which done, the differencing is managed as in logarithmic quantities.—Thus, suppose the differential of the exponential quantity $x^y$ required, let

$$x^y = z$$

$$\text{Then will } y\,lx = lz$$

$$lx\,dy + \frac{y\,dx}{x} = \frac{dz}{z}$$

$$z\,lx\,dy + \frac{zy\,dx}{x} = dz$$

That is, $x^y\,lx\,dy + x^{y-1}\,dx = dz$.

*CALCULUS Integralis, or Summatorius*, is a method of integrating, or summing up moments, or differential quantities; i. e. from a differential quantity given, to find the quantity from whose differencing the given differential results.

The integral calculus, therefore, is the inverse of the differential one: whence the English, who usually call the differential method *fluxions*, give this *calculus*, which ascends from the fluxions, to the flowing or variable quantities: or, as foreigners express it, from the differences to the sums, by the name of the *inverse method of fluxions*.

Hence, the integration is known to be justly performed, if the quantity found, according to the rules of the differential calculus, being differenced, produce that proposed to be summed.

Suppose $\int$ the sign of the sum, or integral quantity, then $\int y\,dx$ will denote the sum, or integral of the differential $y\,dx$.



*To integrate, or sum up a differential quantity*: It is demonstrated, first, that $\int dx = x$: secondly, $\int (dx + dy) = x + y$: thirdly, $\int (x\,dy + y\,dx) = xy$: fourthly, $\int (m\,x^{m-1}\,dx = x^m$: fifthly, $\int (n:m)\,x^{\frac{n-m}{m}}\,dx = x^{\frac{n}{m}}$: sixthly, $\int (y\,dx - x\,dy) : y^2 = x : y$. Of these, the fourth and fifth cases are the most frequent, wherein the differential quantity is integrated, by adding a variable unity to the exponent, and dividing the sum by the new exponent multiplied into the differential of the root: v. g. the fourth case, by $m - (1+1)\,dx$, i. e. by $m\,dx$.

If the differential quantity to be integrated doth not come under any of these formulas, it must either be reduced to an integral finite, or an infinite series, each of whose terms may be summed.

It may be here observed, that, as in the analysis of finites, any quantity may be raised to any degree of power; but *vice versa*, the root cannot be extracted out of any number required: so in the analysis of infinites, any variable or flowing quantity may be differenced; but *vice versa*, any differential cannot be integrated. And as, in the analysis of finites, we are not yet arrived at a method of extracting the roots of all equations, so neither has the integral calculus arrived at its perfection: and as in the former we are obliged to have recourse to approximation, so in the latter we have recourse to infinite series, where we cannot attain to a perfect integration.

*CALCULUS Literalis*, or *Literal CALCULUS*, is the same with specious arithmetic, or algebra, so called from its using the letters of the alphabet; in contradistinction to numeral arithmetic, which uses figures. In the literal calculus given quantities are expressed by the first letters, *a b c d*; and quantities sought by the last *z y x*, &c. Equal quantities are denoted by the same letters.

*CALCULUS Minervæ*, among the ancient lawyers, denoted the decision of a cause, wherein the judges were equally divided. The expression is taken from the history of Orestes, represented by Æschylus and Euripides; at whose trial, before the Areopagites, for the murder of his mother, the votes being equally divided for and against him, Minerva interposed, and gave the casting vote or calculus in his behalf.

M. Cramer, professor at Marpurg, has a discourse express, *De Calculo Minervæ*; wherein he maintains, that all the effect an entire equality of voices can have, is to leave the cause *in statu quo*.

*CALCULUS Tiburtinus*, a sort of figured stone, formed in great plenty about the cataracts of the Anio, and other rivers in Italy; of a white colour, and in shape oblong, round, or echinated. They are a species of the *stiriæ lapideæ*, and generated like them; and so like sugar-plums in the whole, that is a common jest at Rome to deceive the unexperienced by serving them up at deserts.

CALCULUS, in Medicine, the disease of the stone in the bladder, or kidneys. The term is Latin, and signifies a *little pebble*. The calculus in the bladder is called *lithiasis*; and in the kidneys, *nephritis*. See MEDICINE and SURGERY.

Human calculi are commonly formed of different strata

Calcutta.

ftrata or incruftations; fometimes fmooth and heavy like mineral ftones; but oftener rough, fpongy, light, and full of inequalities or protuberances; chemically analyfed, or diftilled in an open fire, they nearly yield the fame principles as urine itfelf, or at leaft an empyreumatic volatile urinous matter, together with a great deal of air. They never have, nor can have naturally, any foreign matter for a bafis: but they may by accident; an inftance of which is related by Dr Percival*. A bougie had unfortunately flipped into the bladder, and upon it a ftone of confiderable fize was formed in lefs than a year. This ftone had fo much the appearance of chalk, that the Doctor was induced to try whether it could be converted into quicklime. His experiment fucceeded, both with that and fome other calculi; from which he conjectures, that hard waters which contain calcareous earth may contribute towards the formation of thefe calculi.

* *Eſſays*, Vol. III. p. 165.

CALCUTTA, the capital of the province of Bengal, and of all the Britifh poffeffions in the Eaft-Indies, is fituated on the river Hughely, a branch of the Ganges, about 100 miles from the fea, in N. Lat. 23. and 88. 28. E. Long. from Greenwich. It is but a modern city, built on the fite of a village called *Govindpour*. The Englifh firft obtained the Mogul's permiffion to fettle in this place in the year 1690; and Mr Job Channock, the company's agent, made choice of the fpot on which the city ftands, on account of a large fhady grove which grew there; though in other refpects it was the worft he could have pitched upon; for three miles to the north coaft, there is a falt-water lake, which overflows in September, and when the flood retires in December, leaves behind fuch a quantity of fifh and other putrefcent matter, as renders the air very unhealthy. The cuftom of the Gentoos throwing the dead bodies of their poor people into the river is alfo very difguftful, and undoubtedly contributes to render the place unhealthy, as well as the caufe already mentioned.

Calcutta is now become a largeand populous city, being fuppofed at prefent to contain 500,000 inhabitans. It is elegantly built, at leaft the part inhabited by the Englifh; but the reft, and that the greateft part, is built after the fafhion of the cities of India in general. The plan of all thefe is nearly the fame; their ftreets are exceedingly confined, narrow, and crooked, with a vaft number of ponds, refervoirs, and gardens interfperfed. A few of the ftreets are paved with brick. The houfes are built, fome with brick, others with mud, and a ftill greater number with bamboes and mats; all which different kinds of fabrics ftanding intermixed with one another, form a very uncouth appearance. The brick houfes are feldom above two ftories high, but thofe of mud and bamboes are only one, and are covered with thatch. The roofs of the brick houfes are flat and terraced. Thefe, however, are much fewer in number than the other two kinds; fo that fires, which often happen, do not fometimes meet with a brick houfe to obftruct their progrefs in a whole ftreet. Within thefe 20 or 25 years Calcutta has been greatly improved both in appearance and in the falubrity of its air: the ftreets have been properly drained, and the ponds filled; thereby removing a vaft furface of ftagnant water, the exhalations of which were particularly hurtful. The citadel is named Fort William, and is fuperior as a fortrefs to any in India; but is now on too extenfive a fcale to anfwer the purpofe for which it was intended, viz. the holding a poft in cafe of extremity. It was begun on this extended plan by lord Clive immediately after the battle of Plaffey. The expence attending it was fuppofed to amount to two millions Sterling.

Calcutta is the emporium of Bengal, and the refidence of the governor-general of India. Its flourifhing ftate may in a great meafure be fuppofed owing to the unlimited toleration of all religions allowed here; the Pagans being fuffered to carry their idols in proceffion, the Mahommedans not being difcountenanced, and the Roman Catholics being allowed a church.— At about a mile diftant from the town is a plain where the natives annually undergo a very ftrange kind of penance on the 9th of April; fome for the fins they have committed, others for thofe they may commit, and others in confequence of a vow made by their parents. This ceremony is performed in the following manner. Thirty bamboes, each about the height of 20 feet, are erected in the plain abovementioned. On the top of thefe they contrive to fix a fwivel, and another bamboe of thirty feet or more croffes it, at both ends of which hangs a rope. The people pull down one end of this rope, and the devotee placing himfelf under it, the Brahmin pinches up a large piece of fkin under both the fhoulderblades, fometimes in the breafts, and thrufts a ftrong iron hook through each. Thefe hooks have lines of Indian grafs hanging to them, which the prieft makes faft to the rope at the end of the crofs bamboe, and at the fame time puts a fafh round the body of the devotee, laying it loofely in the hollow of the hooks, left by the fkin's giving way, he fhould fall to the ground. When this is done, the people haul down the other end of the bamboe; by which means the devotee is immediately lifted up 30 feet or more from the ground, and they run round as faft as their legs can carry them. Thus the devotee is thrown out the whole length of the rope, where, as he fwings, he plays a thoufand antic tricks; being painted and dreffed in a very particular manner, on purpofe to make him look more ridiculous. Some of them continue fwinging half an hour, others lefs. The devotees undergo a preparation of four days for this ceremony. On the firft and third they abftain from all kinds of food; but eat fruit on the other two. During this time of preparation they walk about the ftreets in their fantaftical dreffes, dancing to the found of drums and horns; and fome, to exprefs the greater ardour of devotion, run a rod of iron quite through their tongues, and fometimes through their cheeks alfo.

Before the war of 1755, Calcutta was commonly garrifoned by 300 Europeans, who were frequently employed in conveying the company's veffels from Patna, loaded with falt-petre, piece-goods, opium, and raw filk. The trade of Bengal alone fupplied rich cargoes for 50 or 60 fhips annually, befides what was carried on in fmall veffels to the adjacent countries. It was this flourifhing ftate of Calcutta that probably was one motive for the Nabob Surajah Dowla to attack it in the year 1756. Having had the fort of Coffimbuzar delivered up to him, he marched againft Calcutta with all his forces, amounting to 70,000 horfe and foot,

 with

Calcutta. with 400 elephants, and invested the place on the 15th of June. Previous to any hostilities, however he wrote a letter to Mr Drake the governor, offering to withdraw his troops, on condition that he would pay him his duty on the trade for 15 years past, defray the expence of his army, and deliver up the black merchants who were in the fort. This being refused, he attacked one of the redoubts at the entrance of the town; but was repulsed with great slaughter. On the 16th he attacked another advanced post, but was likewise repulsed with great loss. Notwithstanding this disappointment, however, the attempt was renewed on the 18th, when the troops abandoned these posts, and retreated into the fort; on which the Nabob's troops entered the town, and plundered it for 24 hours. An order was then given to attacking the fort; for which purpose a small breast-work was thrown up, and two twelve pounders mounted upon it; but without firing oftener than two or three times an hour. The governor then called a council of war, when the captain of the train informed them, that there was not ammunition in the fort to serve three days; in consequence of which the principal ladies were sent on board the ships lying before the fort. They were followed by the governor, who declared himself a quaker, and left the place to be defended by Mr Holwell the second in council. Besides the governor, four of the council, eight gentlemen in the company's service, four officers, and 100 soldiers, with 52 free merchants, captains of ships, and other gentlemen, escaped on board the ships, where were also 59 ladies, with 33 of their children. The whole number left in the fort were about 250, effective men, with Mr Holwell, four captains, five lieutenants, six ensigns, and five serjeants; as also 14 sea-captains, and 29 gentlemen of the factory. Mr Holwell then having held a council of war, divided three chests of treasure among the discontented soldiers; making them large promises also, if they behaved with courage and fidelity; after which he boldly stood on the defence of the place, notwithstanding the immense force which opposed him. The attack was very vigorous; the enemy having got possession of the houses, galled the English from thence, and drove them from the bastions; but they themselves were several times dislodged by the fire from the fort, which killed upwards of 12,000 men, with the loss of only five English soldiers the first day. The attack, however, was continued till the afternoon of the 20th; when many of the garrison being killed and wounded, and their ammunition almost exhausted, a flag of truce was hung out. Mr Holwell intended to have availed himself of this opportunity to make his escape on board the ships, but they had fallen several miles down from the fort, without leaving even a single boat to facilitate the escape of those who remained. In the mean time, however, the back-gate was betrayed by the Dutch guard, and the enemy, entering the fort, killed all they first met, and took the rest prisoners.

The fort was taken before six in the evening; and, in an hour after, Mr Holwell had three audiences of the Nabob, the last being in the durbar or council. In all these the governor had the most positive assurances that no harm should happen to any of the prisoners; but he was surprised and enraged at finding only 5000l. in the fort, instead of the immense treasures he expected; and to this, as well as perhaps to the resentment of the jemmidaars or officers, of whom many were killed in the siege, we may impute the catastrophe that followed. Calcutta.

As soon as it was dark, the English prisoners, to the number of 146, were directed by the jemmidaars who guarded them, to collect themselves into one body, and sit down quietly under the arched veranda, or piazza, to the westward of the black-hole prison. Besides the guard over them, another was placed at the south-end of this veranda, to prevent the escape of any of them. About 500 gunmen, with lighted matches, were drawn up on the parade; and soon after the factory was in flames to the right and left of the prisoners, who had various conjectures on this appearance. The fire advanced with rapidity on both sides; and it was the prevailing opinion of the English, that they were to be suffocated between the two fires. On this they soon came to a resolution of rushing on the guard, seizing their scymitars, and attacking the troops upon the parade, rather than be thus tamely roasted to death: but Mr Holwell advanced, and found the Moors were only searching for a place to confine them in. At that time Mr Holwell might have made his escape, by the assistance of Mr Leech, the company's smith, who had escaped when the Moors entered the fort, and returned just as it was dark, to tell Mr Holwell he had provided a boat, and would ensure his escape, if he would follow him through a passage few were acqainted with, and by which he then entered. This might easily have been accomplished, as the guard took little notice of it: but Mr Holwell told Mr Leech, he was resolved to share the fate of the gentlemen and the garrison: to which Mr Leeeh gallantly replied, that "then he was resolved to share Mr Holwell's fate, and would not leave him."

The guard on the parade advanced, and ordered them all to rise and go into the barracks. Then, with their muskets presented, they ordered them to go into the black-hole prison; while others with clubs and scymitars, pressed upon them so strong, that there was no resisting it; but, like one agitated wave impelling another, they were obliged to give way and enter; the rest following like a torrent. Few among them, the soldiers excepted, had the least idea of the dimensions or nature of a place they had never seen; for if they had, they should at all events have rushed upon the guard, and been cut to pieces by their own choice as the lesser evil.

It was about eight o'clock when these 146 unhappy persons, exhausted by continual action and fatigue, were thus crammed together into a dungeon about eighteen feet square, in a close sultry night in Bengal; shut up to the east and south, the only quarters from whence air could reach them, by dead walls, and by a wall and door to the north; open only to the west by two windows, strongly barred with iron, from which they could receive scarce any circulation of fresh air.

They had been but few minutes confined before every one fell into a perspiration so profuse, that no idea can be formed of it. This brought on a raging thirst, which increased in proportion as the body was drained of its moisture. Various expedients were thought

thought of to give more room and air. Every man was ſtripped, and every hat put in motion: they ſeveral times ſat down on their hams; but at each time ſeveral of the poor creatures fell, and were inſtantly ſuffocated or trod to death.

Before nine o'clock every man's thirſt grew intolerable, and reſpiration difficult. Efforts were again made to force the door; but ſtill in vain. Many inſults were uſed to the guards, to provoke them to fire in upon the priſoners, who grew outrageous, and many delirious. "Water, water," became the general cry. Some water was brought; but theſe ſupplies, like ſprinkling water on fire, only ſerved to raiſe and feed the flames. The confuſion became general, and horrid from the cries and ravings for water, and ſome were trampled to death. This ſcene of miſery proved entertainment to the brutal wretches without, who ſupplied them with water, that they might have the ſatisfaction of ſeeing them fight for it, as they phraſed it; and held up lights to the bars, that they might loſe no part of the inhuman diverſion.

Before eleven o'clock, moſt of the gentlemen were dead, and one third of the whole. Thirſt grew intolerable: but Mr Holwell kept his mouth moiſt by ſucking the perſpiration out of his ſhirt-ſleeves, and catching the drops as they fell, like heavy rain, from his head and face. By half an hour after eleven, moſt of the living were in an outrageous delirium. They found that water heightened their uneaſineſſes; and "Air, air," was the general cry. Every inſult that could be deviſed againſt the guard, all the opprobrious names that the viceroy and his officers could be loaded with, were repeated to provoke the guard to fire upon them. Every man had eager hopes of meeting the firſt ſhot. Then a general prayer to heaven, to haſten the approach of the flames to the right and left of them, and put a period to their miſery. Some expired on others; while a ſteam aroſe as well from the living as the dead, which was very offenſive.

About two in the morning, they crowded ſo much to the windows, that many died ſtanding, unable to fall by the throng and equal preſſure round. When the day broke, the ſtench ariſing from the dead bodies was unſufferable. At that juncture, the Soubah, who had received an account of the havoc death had made among them, ſent one of his officers to enquire if the chief ſurvived. Mr Holwell was ſhown to him; and near ſix an an order came for their releaſe.

Thus they had remained in this infernal priſon from eight at night until ſix in the morning, when the poor remains of 146 ſouls, being only 23, came out alive, but moſt of them in a high putrid fever. The dead bodies were dragged out of the hole by the ſoldiers, and thrown promiſcuouſly into the ditch of an unfiniſhed ravelin, which was afterwards filled with earth.

The injuries which Calcutta, ſuffered at this time, however, were ſoon repaired. The place was retaken by Admiral Watſon and Colonel Clive, early in 1757; Surajah Dowla was defeated, depoſed, and put to death; and Meer Jaffier, who ſucceeded him in the Nabobſhip, engaged to pay an immenſe ſum for the indemnification of the inhabitants. Since that time the immenſe acquiſition of territory by the Britiſh in this part of the world, with the conſtant ſtate of ſecurity enjoyed by this city, have given an opportunity of embelliſhing and improving it greatly beyond what it was before.—Among theſe improvements we may reckon that of Sir William Jones; who, on the 15th of January 1784, inſtituted a ſociety for inquiring into the hiſtory civil and natural, the antiquities, arts, ſciences, and literature of Aſia; and thus the literature of Europe, and along with it, it is to be hoped, the arts of humanity, beneficence, and peace, have at length obtained a footing in the rich empire of indoſtan, ſo long a prey to the rapine and violence of tyrants and uſurpers.



CALDARIUM, in the ancient baths, denoted a brazen veſſel or ciſtern, placed in the hypocauſtum, full of hot water, to be drawn thence into the *piſcinia* or bath, to give it the neceſſary degree of heat. In this ſenſe, the *caldarium* ſtood contradiſtinguiſhed from the *tepidarium* and *frigidarium*.

CALDARIUM alſo denoted the ſtove, or ſudatory, being a cloſe vaulted room, wherein by hot dry fumes, without water, people were brought to a profuſe ſweat. In which ſenſe, *caldarium* was the ſame with what was otherwiſe denominated *vaporarium*, *ſudatorium* and *laconium*; in the Greek baths, *hypocauſtum*, ὑποκαυςον.

CALDERINUS (Domitius), a learned critic, born at Calderia near Verona. He read lectures upon polite literature at Rome with great reputation; and was the firſt who ventured to write upon the moſt difficult of the ancient poets. He died very young in 1477.

CALDERON, De la Barca, (Dom. Pedro), a Spaniſh officer, who, after having ſignalized himſelf in the military profeſſion, quitted it for the eccleſiaſtical, and then commenced dramatic writer. His dramatic works make 9 vols in 4to. and ſome Spaniſh authors have compared him to Shakeſpeare. He flouriſhed about the year 1640.

CALDERWOOD (David), a famous divine of the church of Scotland, and a diſtinguiſhed writer in behalf of the Preſbyterians, was deſcended of a good family in that kingdom; and being early deſigned for the miniſtry, he applied with great diligence to the ſtudy of the Scriptures in their original tongues, the works of the fathers, the councils, and the beſt writers on church-hiſtory. He was ſettled about the year 1604 at Crelling near Jedburgh. King James I. of Great Britain, being deſirous of bringing the church of Scotland nearer to a conformity with that of England, laboured earneſtly to reſtore the epiſcopal authority, and enlarge the powers of the biſhops who were then in Scotland. This deſign was very warmly oppoſed by many of the miniſters, and particularly by Mr David Calderwood; who, when Mr James Law, biſhop of Orkney, came to viſit the preſbyteries of Merſe and Teviotdale, declined his juriſdiction by a paper under his hand dated May 5th 1608. But the king having its ſucceſs much at heart, ſent the earl of Dunbar, then high-treaſurer of Scotland, with Dr Abbot afterwards archbiſhop of Canterbury, and two other divines, into that kingdom, with inſtructions to employ every method to perſuade both the clergy and laity of his majeſty's ſincere deſire to promote the good of the church, and of his zeal for the Proteſtant religion. Mr Calderwood did not aſſiſt at the general aſſembly held at Glaſgow June 8th 1610, in which lord Dunbar presided as a commissioner; and it appears from his writings, that he looked upon every thing transacted in it as null and void. In May following, king James went to Scotland; and on the 17th of June held a parliament at Edinburgh: at that time the clergy met in one of the churches, to hear and advise with the bishops; which kind of assembly, it seems, was contrived in order to resemble the English convocation. Mr Calderwood was present at it, but declared publicly that he did not take any such meetings to resemble a convocation; and being opposed by Dr Whitford and Dr Hamilton, who were friends to the bishops, he took his leave of them in these words: "It is absurd to see men sitting in silks and sattins, and to cry poverty in the kirk, when purity is departing." The parliament proceeded in the mean while in the dispatch of business; and Mr Calderwood, with several other ministers, being informed that a bill was depending to empower the king, with the advice of the archbishops, bishops, and such a number of the ministry, as his Majesty should think proper, to consider and conclude as to matters decent for the external policy of the church, not repugnant to the word of God; and that such conclusions should have the strength and power of ecclesiastical laws: against this they protested, for four reasons. 1. Because their church was so perfect, that, instead of needing reformation, it might be a pattern to others. 2. General assemblies, as now established by law, and which ought always to continue, might by this means be overthrown. 3. Because it might be a means of creating schism, and disturb the tranquillity of the church. 4. Because they had received assurances, that no attempts should be made to bring them to a conformity with the church of England. They desired therefore, that, for these and other reasons, all thoughts of passing such a law might be laid aside: but in case this be not done, they protest for themselves and their brethren who shall adhere to them, that they can yield no obedience to this law, when it shall be enacted, because it is destructive of the liberty of the church; and therefore shall submit to such penalties, and think themselves obliged to undergo such punishments, as may be inflicted on them for disobeying that law. This protest was signed by Mr Archibald Simson on behalf of the members who subscribed another separate roll, which he kept for his justification. This protest was presented to the clerk register, who refused to read it before the states in parliament. However though not read, it had its effect; for although the bill had the consent of parliament, yet the king thought fit to cause it to be laid aside, and not long after called a general assembly at St Andrew's. Soon after the parliament was dissolved, Mr Calderwood was summoned to appear before the high commission court at St Andrew's, on the 8th July following, to answer for his mutinous and seditious behaviour. July 10th, the king came to that city in person; when Mr Calderwood, being called upon, and refusing to comply with what the king in person required of him, was commited to prison. Afterwards the privy council, according to the power exercised by them at that time, directed him to banish himself out of the king's dominions before Michaelmas next; and not to return without licence. Having applied to the king for a prorogation of his sentence without success, because he would neither acknowledge his offence, nor promise conformity for the future, he retired to Holland, where, in 1623, he published his celebrated piece entitled *Altare Damascenum*. Mr. Calderwood having in the year 1624 been afflicted with a long fit of sickness, and nothing having been heard of him for some time, one Mr Patrick Scot, as Calderwood himself informs us, took it for granted that he was dead; and thereupon wrote a recantation in his name, as if, before his decease, he had changed his sentiments. This imposture being detected, Scot went over to Holland, and staid three weeks at Amsterdam, where he made a diligent search for the author of Altare Damascenum, with a design to have dispatched him. But Calderwood had privately retired into his own country, where he lived several years. Scot gave out that the king had furnished him with the matter for the pretended recantation, and that he only put it in order. During his retirement, Mr Calderwood collected all the memorials relating to the ecclesiastical affairs of Scotland, from the beginning of the reformation there down to the death of king James; which collection is still preserved in the university library of Glasgow; that which was published under the title of "The true history of Scotland," is only an extract from it. In the advertisement prefixed to the last edition of his Altare Damascenum mention is made of his being minister of Pencaitland near Edinburgh in 1638; but we find nothing said there, or any where else, of his death.



CALDRON, a large kitchen utensil, commonly made of copper; having a moveable iron handle, whereby to hang it on the chimney-hook. The word is formed from the French *Chaudron*, or rather the Latin *caldarium*.

*Boiling in* CALDRONS (*caldariis decoquere*), is a capital punishment spoken of in the middle-age writers, decreed to divers sorts of criminals, but chiefly to debasers of the coin. One of the torments inflicted on the ancient Christian martyrs, was boiling in caldrons of water, oil, &c.

CALDWALL (Richard), a learned English physician, born in Staffordshire about the year 1513. He studied physic in Brazen-Nose college Oxford; and was examined, admitted unto, and made censor of the college of physicians at London, all in one day. Six weeks after he was chosen one of the elects; and in the year 1570 was made president of that college. Mr Wood tells us, that he wrote several pieces in his profession; but he does not tell us what they were, only that he translated a book on the art of surgery, written by one Horatio More, a Florentine physician. We learn from Cambden, that Caldwall founded a chirurgical lecture in the college of physicians, and endowed it with a handsome salary. He died in 1585.

CALEA, in botany: A genus of the polygamia æqualis order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is paleaceous, the pappus hairy, and calyx imbricated.

CALEB, one of the deputies sent by the Israelites to take a view of the land of Canaan. He made a good report of the country, and by this means revived the spirits of the dejected people; on which account, he and Joshua were the only persons who, after their leaving Egypt, settled in the land of Canaan. Caleb had, Caledonia. had, for his ſhare, the mountains and the city of Hebron, from which he drove three kings. Othniel his nephew having taken the city of Debir, Caleb gave him his daughter Achſah in marriage; and died, aged 114.

CALEDONIA, the ancient name of Scotland. From the teſtimonies of Tacitus, Dio, and Solinus, we find, that the ancient Caledonia comprehended all that country lying to the north of the rivers Forth and Clyde. In proportion as the Silures or Cimbri advanced towards the north, the Caledonians, being circumſcribed within narrower limits, were forced to tranſmigrate into the iſlands which crowd the weſtern coaſts of Scotland. It is in this period probably, we ought to place the firſt great migration of the Britiſh Gaël into Ireland; that kingdom being much nearer to the promontory of Galloway and Cantire, than many of the Scottiſh iſles are to the continent of North Britain.

To the country which the Caledonians poſſeſſed, they gave the name of *Caël-doch;* which is the only appellation the Scots, who ſpeak the Gaelic language, know for their own diviſion of Britain. *Caël-doch* is a compound, made up of *Gaël* or *Caël*, the firſt colony of the ancient Gauls who tranſmigrated into Britain, and *doch*, a diſtrict or diviſion of a country. The Romans, by tranſpoſing the letter *l* in *Cael*, and by ſoftening into a Latin termination the *ch* of *doch*, formed the well known name of Caledonia.

When the tribes of North Britain were attacked by the Romans, they entered into aſſociations, that, by uniting their ſtrength, they might be more able to repel the common enemy. The particular name of that tribe, which either its ſuperior power or military reputation placed at the head of the aſſociation, was the general name given by the Romans to all the confederates. Hence it is that the *Mœatæ*, who with other tribes inhabited the diſtricts of Scotland lying ſouthward of the frith, and the *Caledonians*, who inhabited the weſt and north-weſt parts, have engroſſed all the glory which belonged in common, though in an inferior degree, to all the other nations ſettled of old in North Britain. It was for the ſame reaſon that the name of *Mœatæ* was entirely forgotten by foreign writers after the third century, and that of the *Caledonians* themſelves but ſeldom mentioned after the fourth.

*Britons, Caledonians, Mœatæ, Barbarians,* are the names conſtantly given to the old inhabitants of North Britain, by Tacitus, Herodian, Dio, Spartian, Vopiſcus and other ancient writers. The ſucceſſors of theſe Britons, Caledonians, Mœats, and Barbarians, are called Picts, Scots, and Attacots, by ſome Roman writers of the fourth century,

The origin of the appellation *Scoti* and *Picti*, introduced by latter Roman authors, has occaſioned much controverſy among the antiquarians of theſe days. The diſpute ſeems now to be fully decided by ſome learned critics of the preſent century, whoſe knowledge of the Gaelic language aſſiſted their inveſtigation. See SCOTLAND, PICTS, and HIGHLANDERS.

CALEDONIA, the name of a ſettlement made by the Scots on the weſt ſide of the gulph of Darien, in 1698; out of which they were ſtarved at the requeſt of the Eaſt-India company: for the Engliſh government prohibited the other colonies ſending them any proviſions, ſo they were obliged to leave it in 1700. Caledonia.

*New* CALEDONIA, an iſland in the ſouth-ſea, lately diſcovered by captain Cook, and, next to New Holland and New Zealand, is the largeſt iſland that hath yet been diſcovered in that ſea. It extends from 19. 37. to 22. 30. South Lat. and from 163. 37. to 167. 14. E. Long. Its length from north-weſt to ſouth-eaſt is about 80 leagues; but its greateſt breadth does not exceed ten leagues. This iſland is diverſified by hills and valleys of various ſize and extent. From the hills iſſue abundance of rivulets, which contribute to fertilize the plains. Along its north-eaſt ſhore the land is flat; and being well watered, and cultivated by the inhabitants after their manner, appeared to great advantage to captain Cook's people. Was it not, indeed, for thoſe fertile ſpots on the plains, the whole country might be called a *dreary waſte:* the mountains and higher parts of the land are in general incapable of cultivation. They conſiſt chiefly of rocks, many of which are full of mundic; the little ſoil that is upon them is ſcorched and burnt up by the ſun; it is, however, covered with coarſe graſs and other plants, and here and there covered with trees and ſhrubs. The country in general bears a great reſemblance to thoſe parts of New South Wales which lie under the ſame parallel of latitude. Several of its natural productions are the ſame, and the woods are without underwood as well as in that country. The whole coaſt ſeems to be ſurrounded by reefs and ſhoals, which render all acceſs to it extremely dangerous; but at the ſame time guard the coaſts againſt the attacks of the wind and ſea; rendering it eaſily navigable along the coaſt by canoes, and cauſing it abound with fiſh. Every part of the coaſt ſeems to be inhabited; the plantations in the plains are laid out with great judgment, and cultivated with much labour. They begin their cultivation by ſetting fire to the graſs, &c. with which the ground is covered, but have no notion of preſerving its vigour by manure; they, however, recruit it by letting it lie for ſome years untouched. On the beach was found a large irregular maſs of rock, not leſs than a cube of ten feet, conſiſting of a cloſe-grained ſtone ſpeckled full of granates ſomewhat bigger than pins heads, from whence it ſeems probable that ſome valuable minerals may be found on this iſland. It differs from all the other iſlands yet diſcovered in the South Sea, by being entirely deſtitute of volcanic productions. Several plants of a new ſpecies were found here; and a few young breadfruit trees, not then ſufficiently grown to bear fruit, ſeemed to have come up without culture: plantains and ſugar-canes are here in ſmall-quantity, and the cocoa-nut trees are ſmall and thinly planted. A new ſpecies of paſſion-flower was likewiſe met with, which was never known to grow wild any where but in America. Several *Caputi* (MELALEUCA) trees were alſo found in flower. Muſquetos here are very numerous. A great variety of birds were ſeen of different claſſes, which were for the moſt part entirely new; particularly a beautiful ſpecies of parrot before unknown to zoologiſts. A new ſpecies of fiſh, of the genus called by Linnæus *tetraodon*, was caught here; and its liver, which was very large, preſented at ſupper. Several ſpecies of this genus being reckoned poiſonous, and the preſent ſpecies being re-

 markably

Caledonia. markably ugly, Mess. Forsters hinted their suspicions of its quality; but the temptation of a fresh meal, and the assurances of captain Cook, that he had formerly eaten this identical sort of fish without harm, got the better of their scruples, and they eat of it. Its oiliness, however, though it had no other bad taste than what proceeded from this, prevented them from taking more than a morsel or two. In a few hours after they had retired to rest, they were awakened by very alarming symptoms, being all seized with an extreme giddiness; their hands and feet were numbed, so that they were scarcely able to crawl; and a violent langour and oppression seized them. Emetics were administered with some success, but sudorifics gave the greatest relief. Some dogs who had eaten the remainder of the liver were likewise taken ill; and a pig which had eaten the entrails died soon after, having swelled to an unusual size. The effects of this poison on the gentlemen did not go entirly off in less than six weeks.—Abundance of turtle was seen here. The natives had not the least notion of goats, hogs, dogs, or cats, and had not even a name for any of them.

The inhabitants are very stout, tall, and in general well proportioned; their features mild; their beards and hair black, and strongly frizzled, so as to be somewhat woolly in some individuals: their colour is swarthy, or a dark chesnut brown. A few were seen who measured six feet four inches. They are remarkably courteous, not at all addicted to pilfering and stealing; in which character of honesty they are singular, all the other nations in the South Sea being remarkably thievish. Some wear their hair long, and tie it up to the crown of their heads; others suffer only a large lock to grow on each side, which they tie up in clubs; many others, as well as all the women, wear it cropt short. They make use of a kind of comb made of sticks of hard wood, from seven to nine or ten inches long, and about the thickness of knitting needles; a number of these, seldom exceeding 20, but generally fewer, are fastened together at one end, parallel to and near one-tenth of an inch from each other; the ends, which are a little pointed, will spread out or open like the sticks of a fan. These combs they always wear in their hair, on one side of their head. Some had a kind of concave cylindrical stiff black cap, which appeared to be a great ornament among them, and was supposed to be worn only by the chiefs and warriors. A large sheet of strong paper, whenever they got one in exchange, was commonly applied to this purpose. The men go naked; only tying a string round their middle, and another round their neck. A little piece of a brown cloth made of the bark of a fig-tree, sometimes tucked up to the belt, and sometimes pendulous, scarcely deserves the name of a covering; nor indeed does it seem at all intended for that purpose. This piece of cloth is sometimes of such a length, that the extremity is fastened to the string round the neck; to this string they likewise hang small round beads of a pale green nephritic stone. Coarse garments were seen among them made of a sort of matting; but they seemed never to wear them, except when in their canoes and unemployed. The women seemed to be in a servile state: they were the only persons of the family who had any employment, and several of them brought bundles of sticks and fuel on their back: those who had children carried them on their backs in a kind of satchel. The women also were seen to dig up the earth in order to plant it. They are in general of a dark chesnut, and sometimes mohogany brown; their stature middle-sized, some being rather tall, and their whole form rather stout, and somewhat clumsy. Their dress is the most disfiguring that can be imagined, and gives them a thick squat shape; it is a short petticoat or fringe, consisting of filaments or little cords, about eight inches long, which are fastened to a very long string which they have tied several times round their waist. The filaments, or little ropes, therefore, lie above each other in several layers, forming a kind of thick thatch all round the body, but which does not near cover the thigh: these filaments were sometimes dyed black; but frequently those on the outside only were of that colour, the rest being of a dirty grey. There was not a single instance, during the ship's stay in this island, of the women permitting any indecent familiarity with an European: they took pleasure in practising the arts of a jilting coquette, but never became absolute wantons. The general ornaments of both sexes are ear-rings of tortoise shells, necklaces, or amulets, made both of shells and stones; and bracelets made of large shells, which they wear above the elbows.

The houses, or huts, in New Caledonia, are circular, something like a bee-hive, and full as close and warm; the entrance is by a small door, or long square hole, just big enough to admit a man bent double: the side-walls are about four feet and a half high; but the roof is lofty, and peaked to a point at the top, above which is a post or stick of wood, which is generally ornamented either with carving or shells, or both. The framing is of small spars, reeds, &c. and both sides and roof are thick, and close covered with thatch made of coarse long grass. In the inside of the house are set up posts, to which cross spars are fastened, and platforms made for the conveniency of laying any thing on. Some houses have two floors, one above another; the floor is laid with dried grass, and here and there mats are spread for the principal people to sit or sleep on. In these houses there was no passage for the smoke but through the door; they were intolerably smoky, and so hot as to be insupportable to those unaccustomed to them: probably the smoke is intended to drive out the musquetos which swarm here. They commonly erect two or three of these huts near each other under a cluster of lofty fig-trees, whose leaves are impervious to the rays of the sun.

The canoes used here are very heavy clumsy vessels; they are made of two trees hollowed out, having a raised gunnel about two inches high, and closed at each end with a bulk head of the same height; so that the whole is like a long square trough about three feet shorter than the body of the canoe. Two canoes thus fitted are fastened to each other about three feet asunder, by means of cross-spars, which project about a foot over each side. Over these is laid a deck or heavy platform made of plank and small round spars on which they have a fire-hearth, and generally a fire burning; they are navigated by one or two latteen sails, extended to a small latteen yard, the end of which is fixed in a notch or hole in the deck.

Notwithstanding the inoffensive disposition of the inhabitants of New Caledonia, they are well provided with

with offensive weapons; as clubs, spears, darts, and slings for throwing stones. Their clubs are about two feet and an half long, and variously formed; some like a scythe, others like a pick-ax; some have a head like a hawk, and others have round heads; but all are neatly made; many of their darts and spears are no less neat, and ornamented with carvings. The slings are as simple as possible; but they take some pains to form the stones that they use into a proper shape, which is something like an egg, supposing both ends to be like the small one. They drive the dart by the assistance of short cords knobbed at one end and looped at the other, called by the seamen *beckets*. These contain a quantity of red wool taken from the vampyre, or great Indian bat. Bows and arrows are wholly unknown among them.

Their language bears no affinity to that spoken in the other South-sea islands, the word *arrekee*, and one or two more, excepted. This is the more extraordinary, as different dialects of one language were spoken not only in the easterly islands, but at New Zealand.

A musical instrument, a kind of whistle, was procured here. It was a little polished piece of brown wood about two inches long, shaped like a kind of bell, tho' apparently solid, with a rope fixed at the small end; two holes were made in it near the base, and another near the insertion of the rope, all which communicated with each other; and by blowing in the uppermost, a shrill sound like whistling was produced: no other instrument was seen among them that had the least relation to music.

Many of the New Caledonians were seen with prodigiously thick legs and arms, which seemed to be affected with a kind of leprosy; the swelling was found to be extremely hard, but the skin was not alike harsh and scaly in all those who were afflicted with the disorder. The preternatural expansion of the arm or leg did not appear to be a great inconvenience to those who suffered it; and they seemed to intimate that they very rarely felt any pain in it; but in some the disorder began to form blotches, which are marks of a great degree of virulence.

Here they bury their dead in the ground. The grave of a chief who had been slain in battle here resembled a large mole-hill, and was decorated with spears, darts, paddles, &c. all stuck upright in the ground round about it. Lieutenant Pickersgill was showed a chief whom they named *Tea-booma*, and styled their *arrekee* or *king*; but nothing further is known of their government, and nothing at all of their religion.

CALEFACTION, the production of heat in a body from the action of fire, or that impulse impressed by a hot body on others around it. This word is used in pharmacy, by way of distinction from *coction*, which implies boiling; whereas calefaction is only heating a thing.

CALENBERG, a castle of Germany, in the duchy of Brunswic and principality of Calenberg. It is seated on the river Leine, and is 15 miles south of Hanover. It is subject to the duke of Brunswic Lunenburg, elector of Hanover, and king of Great Britain. E. Long. 9. 43. N. Lat. 52. 20.

CALENBERG, a principality of Lower Saxony, and one of the three parts of the duchy of Brunswic, is bounded on the north by the duchy of Verden, on the east by the principality of Zell, on the south by the principalities of Grubenhagen and Wolfenbuttle, and on the west by Westphalia. It belongs to the elector of Hanover.



CALENDAR, in astronomy and chronology. See KALENDER.

CALENDER of prisoners, in law, a list of all the prisoners names in the custody of each respective sheriff.*

* See the article *Execution*.

CALENDARIUM FLORÆ, in botany, a calendar containing an exact register of the respective times in which the plants of any given province or climate germinate, expand, and shed their leaves and flowers, or ripen and disperse their seeds. For particulars on this curious subject, see the articles DEFOLIATIO, EFFLORESCENTIA, FRONDESCENTIA, FRUCTESCENTIA, and GERMINATIO.

CALENDER, a machine used in manufactories to press certain woollen and silken stuffs and linens, to make them smooth, even, and glossy, or to give them waves, or water them, as may be seen in mohairs and tabbies. This instrument is composed of two thick cylinders or rollers, of very hard and well polished wood, round which the stuffs to be calendered are wound: these rollers are placed cross-wise between two very thick boards, the lower serving as a fixed base, and the upper moveable by means of a thick screw with a rope fastened to a spindle which makes its axis: the uppermost board is loaded with large stones weighing 20,000lb. or more. At Paris they have an extraordinary machine of this kind, called the *royal calender*, made by order of M. Colbert. The lower table or plank is made of a block of smooth marble, and the upper is lined with a plate of polished copper.—The alternate motion of the upper board sometimes one way and sometimes another, together with the prodigious weight laid upon it, gives the stuffs their gloss and smoothness; or gives them the waves, by making the cylinders on which they are put roll with great force over the undermost board. When they would put a roller from under the calender, they only incline the undermost board of the machine. The dressing alone, with the many turns they make the stuffs and linens undergo in the calender, gives the waves, or waters them, as the workmen call it. It is a mistake to think, as some have asserted, and Mr Chambers among others, that they use rollers with a shallow indenture or engraving cut into them.

CALENDER OF MONTEITH, a district in the south-west corner of Perthshire in Scotland, from which a branch of the ancient family of Livingston had the title of Earl. The chief seat of the family near Falkirk is also called *Calender*. Both estate and title were forfeited for being engaged in the rebellion 1715.

CALENDERS, a sort of Mahometan friars, so called from Santon Calenderi their founder. This Santon went bare-headed, without a shirt, and with the skin of a wild beast thrown over his shoulders. He wore a kind of apron before, the strings of which were adorned with counterfeit precious stones. His disciples are rather a sect of Epicureans than a society of religious. They honour a tavern as much as they do a mosque; and think they pay as acceptable worship to God by the free use of his creatures, as others do by the greatest austerities and acts of devotion. They are called, in Persia and Arabia, *Abdals*, or *Abdallat*, i. e. persons consecrated to the honour and service of God. Their garment is a single coat, made up of a variety of pieces, and quilted like a rug. They preach in the market-places, and live upon what their auditors bestow on them. They are generally very vicious persons; for which reason they are not admitted into any houses.

CALENDS, in Roman antiquity. See KALENDS.

CALENDULA, the MARIGOLD: 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 naked, there is no pappus, the calyx is polyphyllous and equal, the seeds of the disk membranaceous. Of this there are eight species, none of them natives of Europe. The common kind is so well known as to need no definition; and none of the others merit any, except the fruticosa, which hath lately been introduced from the Cape of Good Hope. It hath a slender shrubby perennial stalk, which rises to the height of seven or eight feet, but requires support: this sends out a great number of weak branches from the bottom to the top, which hang downward unless they are supported: they are garnished with oval leaves, having short flat footstalks; these are of a shining green colour on their upper side, but paler underneath: the flowers come out at the end of the branches, on short naked footstalks. This is easily propagated by cuttings; which may be planted at any time in summer in a shady border, or otherwise shaded with mats in the heat of the day: in five or six weeks these will have taken root, when they should be separately taken up, each put in a separate pot, and placed in the shade till they have taken fresh root; then they may be placed, with other hardy exotic plants, in a sheltered situation, where they may remain till the frost begins, when they must be removed into the green-house, placing them near the windows, that they may enjoy the free air; for this plant only requires protection from frost. The seeds of the common sort may be sown in March or April, where the plants are to remain; and will require no other culture but to keep them clear of weeds, and to thin the plants where they are too thick. The flowers of the common marigold are supposed to be aperient and attenuating, as also cardiac, alexipharmac, and sudorific; they are principally celebrated in uterine obstructions, the jaundice, and for throwing out the small-pox. Their sensible qualities, however, give little foundation for these virtues: thay have scarce any taste, and have no considerable smell. The leaves of the plant discover a viscid sweetishness, accompanied with a more durable saponaceous pungency and warmth; these seem capable of answering some useful purposes as a stimulating, aperient, and antiscorbutic medicine.

CALENTIUS (Elisius), a Neapolitan poet and prose author. He was preceptor to Frederic the son of Ferdinand king of Naples, and the earliest writer on the illegality of putting criminals to death, except for murder. He died in 1503.

CALENTURE, a feverish disorder incident to sailors in hot countries; the principal symptom of which is their imagining the sea to be green fields: hence, attempting to walk abroad in these imaginary places of delight, they are frequently lost. Vomiting, bleeding, a spare diet, and the neutral salts, are recommended in this disorder; a single vomit commonly removing the delirium, and the cooling medicines completing the cure.



CALEPIN (Ambrosius), an Augustin monk of Calepio, whence he took his name, in the 16th century. He is author of a dictionary of eight languages, since augmented by Passerat and others.

CALES (anc. geog.), a municipal city of some note in Campania, at no great distance from Casilinum. The epithet *Calenus* is by Horace and Juvenal applied to a generous wine which the territory produced.

CALETES (anc. geog.), a people of Gallia Celtica, on the confines of Belgica, situated between the sea and the Sequana. Now called *le Pais de Caux*, in Normandy.

CALETURE, a fort on the island of Ceylon, at the mouth of a river of the same name. The Dutch became masters of it in 1655; but were afterwards obliged to leave it. E. Long. 80. 51. N. Lat 6. 38.

CALF, in zoology, the young of the ox kind.

There are two ways of breeding calves that are intended to be reared. The one is to let the calf run about with its dam all the year round; which is the method in the cheap breeding countries, and is generally allowed to make the best cattle. The other is to take them from the dam after they have sucked about a fortnight: they are then to be taught to drink flat milk, which is to be made but just warm for them, it being very dangerous to give it them too hot. The best time of weaning calves is from January to May: they should have milk for 12 weeks after; and a fortnight before that is left off, water should be mixed with the milk in larger and larger quantities. When the calf has been fed on milk for about a month, little whisps of hay should be placed all about him in cleft sticks to induce him to eat. In the beginning of April they should be turned out to grass; only for a few days they should be taken in for the night, and have milk and water given them: the same may also be given them in a pail sometimes in the field, till they are so able to feed themselves that they do not regard it. The grass they are turned into must not be too rank, but short and sweet, that they may like it, and yet get it with some labour. Calves should always be weaned at grass; for if it be done with hay and water, they often grow big-belly'd on it, and are apt to rot. When those among the males are selected which are to be kept as bulls, the rest should be gelt for oxen: the sooner the better. Between 10 and 20 days is a proper age. About London almost all the calves are fatted for the butcher. The reason of this is, that there is a good market for them; and the lands there are not so profitable to breed upon as in cheaper countries. The way to make calves fat and fine is, the keeping them very clean; giving them fresh litter every day; and the hanging a large chalk-stone in some corner where they can easily get at it to lick it, but where it is out of the way of being fouled by their dung and urine. The coops are to be placed so as not to have too much sun upon them, and so high above the ground that the urine may ran off. They also bleed them once when they are a month old, and a second time before they

kill

Calf.

kill them; which is a great addition to the beauty and whiteneſs of their fleſh: the bleeding is by ſome repeated much oftener, but this is ſufficient. Calves are very apt to be looſe in their bowels; which waſtes and very much injures them. The remedy is to give them chalk ſcraped among milk, pouring it down with a horn. If this does not ſucceed, they give them bole armenic in large doſes, and uſe the cold bath every morning. If a cow will not let a ſtrange calf ſuck her, the common method is to rub both her noſe and the calf's with a little brandy; this generally reconciles them after a few ſmellings.

*Golden* CALF, an idol ſet up and worſhipped by the Iſraelites at the foot of Mount Sinai in their paſſage through the wilderneſs to the land of Canaan. Our verſion makes Aaron faſhion this calf with a graving tool after he had caſt it in a mould: the Geneva tranſlation makes him engrave it firſt, and caſt it afterwards. Others, with more probability, render the whole verſe thus: "And Aaron received them (the golden earrings), and tied them up in a bag, and got them caſt into a molten calf;" which verſion is authoriſed by the different ſenſes of the word *tzur*, which ſignifies to tie up or bind, as well as to ſhape or form; and of the word *cherret*, which is uſed both for a graving tool and a bag. Some of the ancient fathers have been of opinion that this idol had only the face of a calf, and the ſhape of a man from the neck downwards, in imitation of the Egyptian Iſis. Others have thought it was only the head of an ox without a body. But the moſt general opinion is, that it was an entire calf in imitation of the Apis worſhipped by the Egyptians; among whom, no doubt, the Iſraelites had acquired their propenſity to idolatry. This calf Moſes is ſaid to have *burnt with fire*, reduced to powder, and ſtrewed upon the water which the people were to drink. How this could be accompliſhed hath been a queſtion. Moſt people have thought, that as gold is indeſtructible, it could only be burnt by the miraculous power of God; but M. Stahl conjectures that Moſes diſſolved it by means of liver of ſulphur*. The Rabbins tell us that the people were made to drink of this water in order to diſtinguiſh the idolaters from the reſt; for that as ſoon as they had drunk of it, the beards of the former turned red. The cabbaliſts add, that the calf weighed 125 quintals; which they gather from the Hebrew word *maſſekah*, whoſe numerical letters make 125.

* See *Chemiſtry Index*

CALF-*Skins*, in the leather manufacture, are prepared and dreſſed by the tanners, ſkinners, and curriers, who ſell them for the uſe of the ſhoe-makers, ſadlers, book-binders, and other artificers, who employ them in their ſeveral manufactures.

CALF-*Skin dreſſed in ſumach*, denotes the ſkin of this animal curried black on the hair ſide, and dyed of an orange colour on the fleſh ſide, by means of ſumach, chiefly uſed in the making of belts.

The Engliſh calf-ſkin is much valued abroad, and the commerce thereof very conſiderable in France and other countries; where divers attempts have been made to imitate it, but hitherto in vain. What is like to baffle all endeavours for imitating the Engliſh calf in France is, the ſmallneſs and weakneſs of the calves about Paris; which at fifteen days old are not ſo big at the Engliſh ones when they come into the world.

*Sea*-CALF. See PHOCA.

Calf.
Caliber.

CALI, a town of Popayan in South America, ſeated in a valley of the ſame name on the river Cauca. The governor of the province uſually reſides there. W. Long. 78. 5. N. Lat. 3. 15.

CALIBER, or CALIPER, properly denotes the diameter of any body; thus we ſay, two columns of the ſame caliber, the caliber of the bore of a gun, the caliber of a bullet, &c.

CALIBER-*Compaſſes*, a ſort of compaſſes made with arched legs to take the diameter of round or ſwelling bodies. See COMPASSES.

Caliber-compaſſes, are chiefly uſed by gunners, for taking the diameters of the ſeveral parts of a piece of ordnance, or of bombs, bullets, &c. Their legs are therefore circular; and move on an arch of braſs, whereon is marked the inches and half inches, to ſhow how far the points of the compaſſes are opened aſunder.

Some are alſo made for taking the diameter of the bore of a gun or mortar.

The gaugers alſo ſometimes uſe calibers, to embrace the two heads of any caſk, in order to find its length.

The calibers uſed by carpenters and joiners, is a piece of board notched triangular-wiſe in the middle for the taking of meaſure.

CALIBER-*Rule*, or *Gunner's* CALLIPERS, is an inſtrument wherein a right line is ſo divided as that the firſt part being equal to the diameter of an iron or leaden ball of one pound weight, the other parts are to the firſt as the diameters of balls of two, three, four, &c. pounds are to the diameter of a ball of one pound. The caliber is uſed by engineers, from the weight of the ball given, to determine its diameter or caliber, or *vice verſa*.

The gunner's callipers conſiſt of two thin plates of braſs joined by a rivet, ſo as to move quite round each other: its length from the centre of the joint is between ſix inches and a foot, and its breadth from one to two inches; that of the moſt convenient ſize is about nine inches long. Many ſcales, tables, and proportions, &c. may be introduced on this inſtrument; but none are eſſential to it, except thoſe for taking the caliber of ſhot and cannon, and for meaſuring the magnitude of ſaliant and entering angles. The moſt complete callipers is exhibited Plate CXII. the furniture and uſe of which we ſhall now briefly deſcribe. Let the four faces of this inſtrument be diſtinguiſhed by the letters A, B, C, D: A and D conſiſt of a circular head and leg; B and C conſiſt only of a leg.

On the circular head adjoining to the head of the face A are diviſions denominated *ſhot diameters*; which ſhow the diſtance in inches and tenths of an inch of the points of the callipers when they are opened; ſo that if a ball not exceeding ten inches be introduced between them, the bevil edge E marks its diameter among theſe diviſions.

On the circular bevil part E of the face B is a ſcale of diviſions diſtinguiſhed by *lb. weight of iron ſhot*. When the diameter of any ſhot is taken between the points of the callipers, the inner edge of the leg A ſhows its weight in avoirdupoiſe pounds, provided it be lb. $\frac{1}{4}$, $1\frac{1}{2}$, 2, 3, 4, $5\frac{1}{4}$, 6, 8, 9, 12, 16, 18, 24, 26, 32, 36, or 42; the figures neareſt the bevil edge anſwering to the ſhort lines in the ſcale, and thoſe behind them to the longer ſtroke. This ſcale is con-

ſtructed

ſtructed on the following geometrical theorem, *viz.* that the weights of ſpheres are as the cubes of their diameters.

On the lower part of the circular head of the face A is a ſcale of diviſions marked *bores of guns;* for the uſe of which, the legs of the callipers are ſlipped acroſs each other, till the ſteel points touch the concave ſurface of the gun in its greateſt breadth; then the bevil edge F of the face B will cut a diviſion in the ſcale ſhowing the diameter of the bore in inches and tenths.

Within the ſcales of *ſhot* and *bore* diameters on the circular part of A, are diviſions marked *pounders:* the inner figures $\frac{1}{2}$, $1\frac{1}{2}$, 3, $5\frac{1}{2}$, 8, 12, 18, 26, 36, correſpond to the longeſt lines; and the figures 1, 2, 4, 6, 9, 16, 24, 32, 42, to the ſhort ſtrokes. When the bore of a gun is taken between the points of the callipers, the bevil edge F will either cut or be near one of theſe diviſions, and ſhow the weight of iron-ſhot proper for that gun.

On the upper half of the circular head of the face A are three concentric ſcales of degrees; the outer ſcale conſiſting of 180 degrees numbered from right to left, 10, 20, &c. the middle numbered the contrary way, and the outer ſcale beginning at the middle with 0, and numbered on each ſide to 90 degrees. Theſe ſcales ſerve to take the quantity of an angle, either entering or ſaliant. For an entering or internal angle, apply the legs of the callipers ſo that its outward edges coincide with the legs of the given angle, the degree cut by the bevil edge F in the outer ſcale ſhows the meaſure of the angle ſought: for a ſaliant or external angle, ſlip the edges of the callipers acroſs each other, ſo that their outward edges may coincide with the legs forming the angle, and the degree marked on the middle ſcale by the bevil edge E will ſhow the meaſure of the angle required. The inner ſcale will ſerve to determine the elevation of cannon and mortars, or of any oblique plane. Let one end of a thread be fixed into the notch on the plate B, and any weight tied to the other end: apply the ſtraight ſide of the plate A to the ſide of the body whoſe inclination is ſought; hold it in this poſition, and move the plate B, till the thread falls upon the line near the centre marked *Perp.* Then with the bevil edge F cut the degrees on the inner ſcale, ſhowing the inclination of that body to the horizon.

On the face C near the point of the callipers is a little table ſhowing the proportion of troy and avoirdupoiſe weights, by which one kind of weight may be eaſily reduced into another.

Near the extreme of the face D of the callipers are two tables ſhowing the proportion between the pounds weight of London and Paris, and alſo between the lengths of the foot meaſure of England and France.

Near the extreme on the face A is a table containing four rules of the circle and ſphere; and geometrical figures with numbers annexed to them: the firſt is a circle including the proportion in round numbers of the diameter to its circumference; the ſecond is a circle inſcribed in a ſquare, and a ſquare within that circle, and another circle in the inner ſquare: the numbers 28, 22, above this figure exhibit the proportion of the outward ſquare to the area of the inſcribed circle; and the numbers 14, 11, below it ſhow the proportion between the area of the inſcribed ſquare and the area of its inſcribed circle. The third is a cube inſcribed in a ſphere; and the number $89\frac{1}{3}$ ſhows that a cube of iron, inſcribed in a ſphere of 12 inches in diameter, weighs $89\frac{1}{3}$. The fourth is a ſphere in a cube, and the number 243 expreſſes the weight in pounds of a ſphere inſcribed in a cube whoſe ſide is 12 inches: the fifth repreſents a cylinder and cone of one foot diameter and height: the number in the cylinder ſhows, that an iron cylinder of that diameter and height weighs 364,5 lb. and the number 121.5 in the cone expreſſes the weight of a cone, the diameter of whoſe baſe is 12 inches, and of the ſame height: the ſixth figure ſhows that an iron cube, whoſe ſide is 12 inches, weighs 464 lb. and that a ſquare pyramid of iron, whoſe baſe is a ſquare foot, and height 12 inches, weighs $154\frac{2}{3}$ lb. The numbers which have been hitherto fixed to the four laſt figures were not ſtrictly true; and therefore they have been corrected in the figure here referred to; and by theſe the figures on any inſtrument of this kind ſhould be corrected likewiſe.



On the leg B of the callipers, is a table ſhowing the weights of a cubic inch or foot of various bodies in pounds avoirdupoiſe.

On the face D of the circular head of the callipers is a table contained between five concentric ſegments of rings: the inner one marked *Guns* ſhows the nature of the gun or the weight of ball it carries; the two next rings contain the quantity of powder uſed for proof and ſervice to braſs guns, and the two outermoſt rings ſhow the quantity for proof and ſervice in iron cannon.

On the face A is a table exhibiting the method of computing the *number of ſhot or ſhells* in a triangular, ſquare, or rectangular pile. Near this is placed a table containing the principal rules relative to the *fall of bodies*, expreſſed in an algebraic manner: nearer the centre we have another table of rules for raiſing water, calculated on the ſuppoſition, that one horſe is equal in this kind of labour to five men, and that one man will raiſe a hogſhead of water to eight feet of height in one minute, and work at that rate for ſome hours. N. B. Hogſheads are reckoned at ſixty gallons.

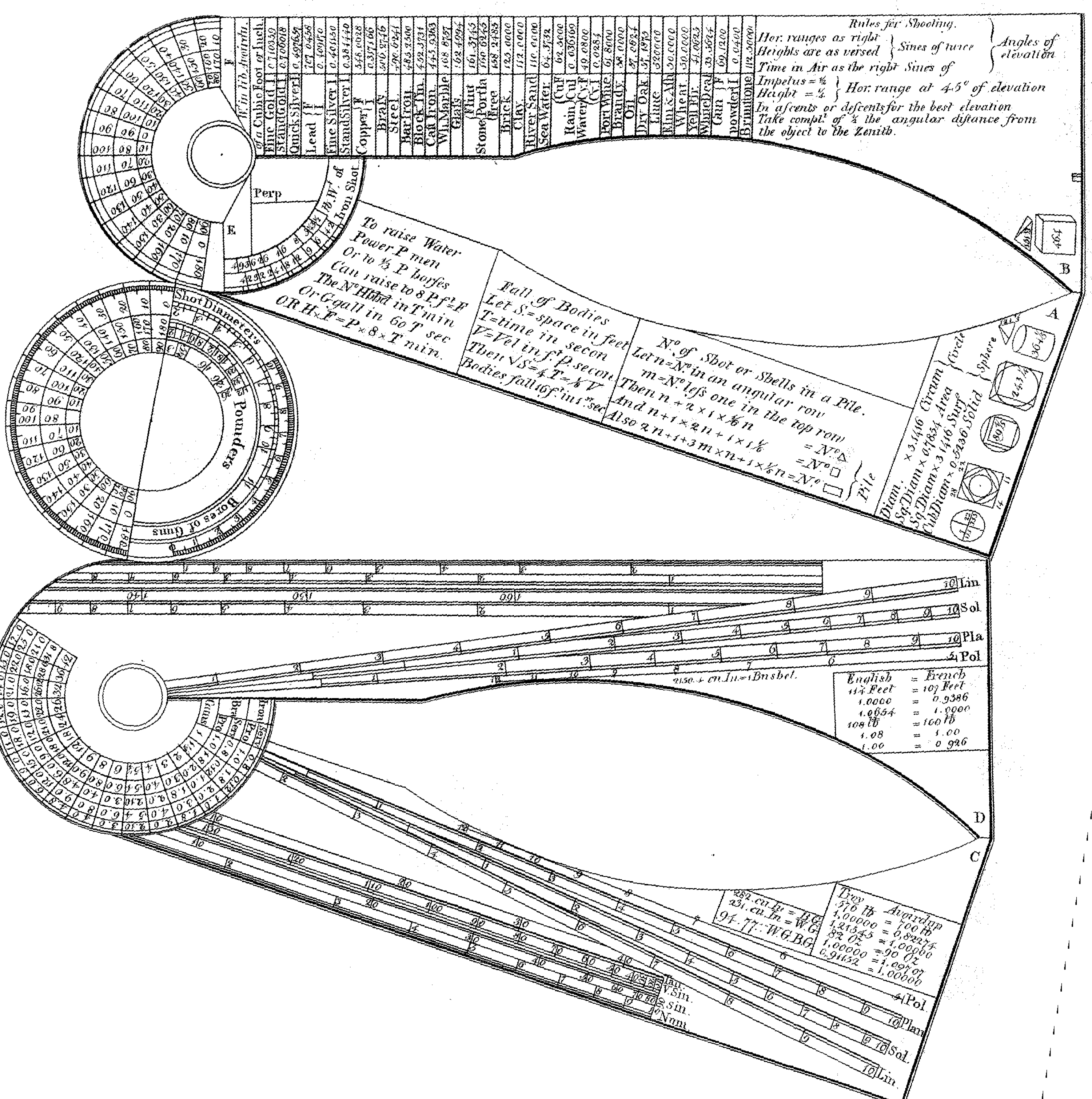
Some of the leading principles in gunnery, relating to *ſhooting* in cannon and mortars, are expreſſed on the face B of the callipers. Beſides the articles already enumerated, the ſcales uſually marked on the ſector are laid down on this inſtrument: thus, the line of inches is placed on the edge of the callipers, or on the ſtraight borders of the faces C, D: the logarithmic ſcales of numbers, ſines, verſed ſines, and tangents, are placed along theſe faces near the ſtraight edges: the line of lines is placed on the ſame faces in an angular poſition, and marked *Lin.* The lines of planes or ſuperficies are alſo exhibited on the faces C and D, tending towards the centre, and marked *Plan.* Finally, the lines of ſolids are laid on the ſame faces tending towards the centre, and diſtinguiſhed by *Sol.*

CALICOULAN, or QUILLON, a town of Aſia, in the Eaſt-Indies, on the coaſt of Malabar, and in the peninſula on this ſide the Ganges, where the Dutch have a factory. E. Long. 75. 21. N. Lat. 9. 5.

CALICUT, a kingdom of India, on this ſide the Ganges, upon the coaſt of Malabar. It is about 63 miles long, and as much broad. It has many woods, rivers and marſhes, and is very populous; but does not produce much corn, abundance of rice being imported

*CALIBER Rule.*

Plate CXII.



*Thackara & Vallance Sculp.t*

Calicut, || California. ported from Canara. The land along the sea-coast is low and sandy, and produces a number of cocoa-trees. The higher grounds produce pepper and cardamoms of a very good quality. They have likewise timber for building, white and yellow sanders, cassia lignea, cassia fistula, nux vomica, and cocculus indicus. The woods abound with parrots and monkeys, as well as different kinds of game. They have also plenty of fish, several sorts of medicinal drugs, and their mountains produce iron. The *samorin*, or king, of Calicut, was once master of all the coast of Malabar; but at his death, he left it by will among four of his nephews. He who governs Calicut has a palace of stone, and there is some appearance of grandeur about his court. He carries on a considerable trade, which makes the people of Calicut richer than their neighbours. In former times they had several strange customs, some of which are still kept up; particularly the samorin's wife must be first enjoyed by the high priest, who may have her three nights if he pleases. The nobles permit the other priests to take the same liberty, but the lower people cannot have that honour. A woman may marry a number of husbands; each of whom has her ten days or more by turns, as they agree among themselves: and provides her all things necessary during that time. When she proves with child, she names the father; who, after the child is weaned, takes care of its education. These people have no pens, ink, or paper; but write with a bodkin on flags that grow by the sides of the rivers. By this means the letters are in some sense engraved; and so tough are the flags, that they will last for a great number of years. This was the first land discovered by the Portuguese in 1498.

Calicut, a town of Asia, in the kingdom of that name on the coast of Malabar. It contains a great number of mean low houses, each of which has a garden. The English had a factory here, but it is removed to Tilichery. E. Long. 76. 4. N. Lat. 11. 21.

CALIDÆ plantæ (from *calor* heat); plants that are natives of warm climates. Such are those of the East Indies, South America, Egypt, and the Canary Islands. These plants, says Linnæus, will bear a degree of heat which is as 40 on a scale in which the freezing point is 0, and 100 the heat of boiling water. In the 10th degree of cold they cease to grow, lose their leaves, become barren, are suffocated, and perish.

CALIDUCT, in antiquity, a kind of pipes or canal disposed along the walls of houses or apartments, used by the ancients for conveying heat to several remote parts of the house from one common furnace.

CALIFORNIA, the most northerly of all the Spanish dominions on the continent of America, is sometimes distinguished by the name of *New Albion*, and the *Islas Carabiras*: but the most ancient appellation is *California*; a word probably owing to some accident, or to some words spoken by the Indians and misunderstood by the Spaniards. For a long time California was thought to be an island; but Father Caino, a German Jesuit, discovered it to be a peninsula joining to the coast of New Mexico and the southern parts of America. This peninsula extends from Cape St Sebastian, lying in north latitude 43. 30. to Cape St Lucar which lies in north latitude 22. 32. It is divided from New Mexico by the gulph, or as some call it the *lake*, of California, or *Vermilion Sea*, on the east; on the north, by that part of the continent of North America which is least known; and on the west and south, by the Pacific Ocean or great South Sea. The coasts, especially towards the Vermilion Sea, are covered with inhabited islands, on some of which the Jesuits have established settlements, such as St Clement, Paxaros, St Anne, Cedars (so called from the great number of these trees it produces), St Joseph, and a multitude of others. But the islands best known are three lying off Cape St Lucar, towards the Mexican coast. These are called *Les Tres Marias*, "the three Maries." They are but small, have good wood and water, salt pits, and abundance of game; therefore the English and French pirates have sometimes wintered there, when bound on cruizes in the South Seas.

California.

As California lies altogether within the temperate zone, the natives are neither chilled with cold nor scorched with heat; and indeed the improvements in agriculture made by the Jesuits afford strong proofs of the excellency of the climate. In some places the air is extremely hot and dry; and the earth wild, rugged, and barren. In a country stretching about 800 miles in length, there must be considerable variations of soil and climate; and indeed, we find from good authority, that California produces some of the most beautiful lawns, as well as many of the most inhospitable desarts, in the universe. Upon the whole, although California is rather rough and craggy, we are assured by the Jesuit Vinegas, and other good writers, that with due culture it furnishes every necessary and conveniency of life; and that, even where the atmosphere is hottest, vapours rising from the sea, and dispersed by pleasant breezes, render it of a moderate temperature.

The peninsula of California is now stocked with all sorts of domestic animals known in Spain and Mexico. Horses, mules, asses, oxen, sheep, hogs, goats, and all other quadrupeds imported, thrive and increase in this country. Among the native animals is a species of deer of the size of a young heifer, and greatly resembling it in shape; the head is like that of a deer, and the horns thick and crooked like those of a ram. The hoof of the animal is large, round, and cloven, the skin spotted, but the hair thinner and the tail sharper than those of a deer. Its flesh is greatly esteemed. There is another animal peculiar to this country, larger and more bulky than a sheep, but greatly resembling it in figure, and, like it, covered with a fine black or white wool. The flesh of this animal is nourishing and delicious; and, happily for the natives, it is so abundant, that nothing more is required than the touble of hunting, as these animals wander about in droves in the forests and on the mountains. Father Torquemado describes a creature which he calls a *species of large bear*, something like a buffalo, of the size of a steer, and nearly of the figure of a stag. Its hair is a quarter of a yard in length, its neck long and aukward, and on its forehead are horns branched like those of a stag. The tail is a yard in length, and half a yard in breadth, and the hoofs cloven like those of an ox. With regard to birds, we have but an imperfect account; only, in general, Father Vinegas tells us that the coast is plentifully stored with peacocks, bustards, geese, cranes, and most of the birds common in other parts of the world. The quantity of fish which resort to these coasts

coasts are incredible. Salmon, turbot, barbel, skate, mackarel, &c. are caught here with very little trouble; together with pearl oysters, common oysters, lobsters, and a variety of exquisite shell-fish. Plenty of turtle are also caught on the coasts. On the South Sea coasts are some shell-fish peculiar to it, and perhaps the most beautiful in the world; their lustre surpassing that of the finest pearl, and darting their rays through a transparent varnish of an elegant vivid blue, like the lapis lazuli. The fame of California for pearls soon drew forth great numbers of adventurers, who searched every part of the gulph, and are still employed in that work, notwithstanding fashion has greatly diminished the value of this elegant natural production. Father Torquimado observes that the sea of California affords very rich pearl fisheries; and that the *hostias*, or beds of oysters, may be seen in three or four fathom water, almost as plain as if they were on the surface.

The extremity of the peninsula towards Cape St Lucar is more level, temperate, and fertile, than the other parts, and consequently more woody. In the more distant parts, even to the farthest missions on the east coast, no large timber hath yet been discovered. A species of manna is found in this country, which, according to the accounts of the Jesuits, has all the sweetness of refined sugar without its whiteness. The natives firmly believe that this juice drops from heaven.

The Californians are well made, and very strong. They are extremely pusilanimous, inconstant, stupid, and even insensible, and seem extremely deserving of the character given to the Indians in general, under the article AMERICA. Before the Europeans penetrated into California, the natives had no form of religion. The missionaries indeed tell us many tales concerning them, but they so evidently bear the marks of forgery as not to be worth repeating. Each nation was then an assemblage of several cottages more or less numerous, that were all mutually confederated by alliances, but without any chief. They were strangers even to filial obedience. No kind of dress was used by the men; but the women made use of some coverings, and were even fond of ornamenting themselves with pearls and such other trinkets as the country afforded. What mostly displayed their ingenuity was the construction of their fishing nets, which are said by the Jesuits to have even exceeded in goodness those made in Europe. They were made by the women, of a coarse kind of flax procured from some plants which grow there. Their houses were built of branches and leaves of trees; nay, many of them were only inclosures of earth and stone, raised half a yard high, without any covering; and even these were so small, that they could not stretch themselves at length in them. In winter, they dwelt under ground in caves either natural or artificial.

In 1526, Ferdinand Cortez having reduced and settled Mexico, attempted the conquest of California; but was obliged to return, without even taking a survey of the country, a report of his death having disposed the Mexicans to a general insurrection. Some other attempts were made by the officers of Cortez, but these were also unsuccessful; and this valuable coast was long neglected by the Spaniards, who, to this day, have but one settlement upon it. In 1595, a galleon was sent to make discoveries on the Californian shore; but the vessel was unfortunately lost. Seven years after the count de Monteroy, then viceroy of New Spain, sent Sebastian Biscayno on the same design with two ships and a tender; but he made no discovery of importance. In 1684, the marquis de Laguna, also viceroy of New Spain, dispatched two ships with a tender to make discoveries on the lake of California. He returned with an indifferent account, but was among the first that asserted that California was not an island; which was afterwards confirmed by Father Caino, as already related. In 1697, the Spaniards being discouraged by their losses and disappointments, the Jesuits solicited and obtained permission to undertake the conquest of California. They arrived among the savages with curiosities that might amuse them, corn for their food, and clothes for which they could not but perceive the necessity. The hatred these people bore the Spanish name could not support itself against these demonstrations of benevolence. They testified their acknowledgments as much as their want of sensibility and their inconstancy would permit them. These faults were partly overcome by the religious institutors, who pursued their project with a degree of warmth and resolution peculiar to the society. They made themselves carpenters, masons, weavers, and husbandmen; and by these means succeeded in imparting knowledge, and in some measure a taste for the useful arts, to this savage people, who have been all successively formed into one body. In 1745, they composed 43 villages separated from each other by the barrenness of the soil and the want of water. The inhabitants of these small villages subsist principally on corn and pulse, which they cultivate; and on the fruits and domestic animals of Europe, the breeding of which last is an object of continual attention. The Indians have each their field, and the property of what they reap; but such is their want of foresight, that they would squander in a day what they had gathered, if the missionary did not take upon himself to distribute it to them as they stand in need of it. They manufacture some coarse stuffs; and the necessaries they are in want of are purchased with pearls, and with wine nearly resembling that of Madeira, which they sell to the Mexicans and to the galleons, and which experience hath shown the necessity of prohibiting in California. A few laws, which are very simple, are sufficient to regulate this rising state. In order to enforce them, the missionary chooses the most intelligent person of the village; who is empowered to whip and imprison; the only punishments of which they have any knowledge. In all California there are only two garrisons, each consisting of 30 men and a soldier with every missionary. These troops were chosen by the legislators, though they are paid by the government. Were the court of Madrid to push their interest with half the zeal of the Jesuits, California might become one of the most valuable of their acquisitions, on account of the pearls and other valuable articles of commerce which the country contains. At present the little Spanish town near Cape St Lucar is made use of for no other purpose than as a place of refreshment for the Manila ships, and the head residence of the missionaries.



CALIGA, in Roman antiquity, was the proper sol-

ſoldier's ſhoe, made in the ſandal faſhion, without upper leather to cover the ſuperior part of the foot, tho' otherwiſe reaching to the middle of the leg, and faſtened with thongs. The ſole of the caliga was of wood, like the ſabot of the French peaſants, and its bottom ſtuck full of nails; which clavi are ſuppoſed to have been very long in the ſhoes of the ſcouts and ſentinels; whence theſe were called by way of diſtinction, *caligæ ſpeculatoriæ;* as if by mounting the wearer to a higher pitch, they gave a greater advantage to the ſight: though others will have the *caligæ ſpeculatoriæ* to have been made ſoft and woolly, to prevent their making a noiſe. From theſe *caligæ* it was that the emperor Caligula took his name, as having been born in the army, and afterwards bred up in the habit of a common ſoldier.

According to Du Cange, a ſort of *caligæ* was alſo worn by monks and biſhops, when they celebrated maſs pontifically.

CALIGATI, an appellation given by ſome ancient writers to the common ſoldiers in the Roman armies, by reaſon of the caliga which they wore. The caliga was the badge or ſymbol of a ſoldier; whence to take away the caliga and belt, imported a diſmiſſing or caſhiering.

CALIGO, or CALIGATIO, in Medicine, an opacity, or cloudineſs of the anterior ſurface of the cryſtalline, cauſing a dimneſs or ſuffuſion of ſight.

CALIGULA, the Roman emperor and tyrant, A. D. 37, began his reign with every promiſing appearance of becoming the real father of his people; but at the end of eight months he was ſeized with a fever, which, it is thought, left a frenzy on his mind: for his diſpoſition totally changed, and he committed the moſt atrocious acts of impiety, cruelty, and folly; ſuch as proclaiming his horſe conſul, feeding it at his table, introducing it to the temple in the veſtments of the prieſts of Jupiter, &c. and cauſing ſacrifices to be offered to himſelf, his wife, and the horſe. After having murdered many of his ſubjects with his own hand, and cauſed others to be put to death without any juſt cauſe, he was aſſaſſinated by a tribune of the people as he came out of the amphitheatre, A. D. 41, in the 29th year of his age, and 4th of his reign.

CALIN, a compound metal, whereof the Chineſe make tea-caniſters, and the like. The ingredients ſeem to be lead and tin.

CALIPH, or KHALIF, the ſupreme eccleſiaſtical dignity among the Saracens; or, as it is otherwiſe defined, a ſovereign dignity among the Mahometans, veſted with abſolute authority in all matters relating both to religion and policy. In the Arabic it ſignifies *ſucceſſor* or *vicar;* the caliphs bearing the ſame relation to Mahomet that the popes pretend they do to Jeſus Chriſt or St Peter. It is at this day one of the Grand Signior's titles, as ſucceſſor of Mahomet; and of the Sophi of Perſia, as ſucceſſor of Ali. One of the chief functions of the caliph, in quality of imam or chief prieſt of Muſſulmaniſm, was to begin the public prayers every Friday in the chief moſque, and to deliver the *khothbah* or ſermon. In after-times, they had aſſiſtants for this latter office; but the former the caliphs always performed in perſon. The caliph was alſo obliged to lead the pilgrims to Mecca in perſon, and to march at the head of the armies of his empire. He granted inveſtiture to princes; and ſent ſwords, ſtandards, gowns, and the like, as preſents to princes of the Mahometan religion; who, though they had thrown off the yoke of the caliphate, nevertheleſs held of it as vaſſals. The caliphs uſually went to the moſque mounted on mules; and the ſultans ſelgiucides, though maſters of Bagdad, held their ſtirrups, and led their mule by the bridle ſome diſtance on foot, till ſuch time as the caliphs gave them the ſign to mount on horſeback. At one of the windows of the caliph's palace, there always hung a piece of black velvet 20 cubits long, which reached to the ground, and was called the *caliph's ſleeve;* which the grandees of his court never failed to kiſs every day, with great reſpect. After the deſtruction of the caliphate by Hulaku, the Mahometan princes appointed a particular officer, in their reſpective dominions, who ſuſtains the ſacred authority of caliph. In Turkey, he goes under the denomination of *mufti*, and in Perſia under that of *ſadne*.



CALIPHATE, the office or dignity of caliph: See the preceding article. The ſucceſſion of caliphs continued from the death of Mahomet till the 655th year of the Hegira, when the city of Bagdad was taken by the Tartars. After this, however, there were perſons who claimed the caliphate, as pretending to be of the family of the Abaſſides, and to whom the ſultans of Egypt rendered great honours at Cairo, as the true ſucceſſors of Mahomet: but this honour was merely titular, and the rights allowed them only in matters relating to religion; and though they bore the ſovereign title of *caliphs*, they were nevertheleſs ſubjects and dependents of the ſultans. In the year of the Hegira 361, a kind of caliphate was erected by the Fatemites in Africa, and laſted till it was ſuppreſſed by Saladdin. Hiſtorians alſo ſpeak of a third caliphate in Gemen or Arabia Felix, erected by ſome princes of the family of the Jobites. The emperors of Morocco aſſume the title of *grand cheriſs;* and pretend to be the true caliphs, or ſucceſſors of Mahomet, though under another name.

CALIPPIC PERIOD, in chronology, a ſeries of ſeventy-ſix years, perpetually recurring; which elapſed, the middle of the new and full moons, as its inventor Calippus, an Athenian, imagined, return to the ſame day of the ſolar year. Meton, an hundred years before, had invented the period, or cycle, of nineteen years: aſſuming the quantity of the ſolar year $365\,d.\ 6\,h.\ 18'\ 56''\ 50^{3}\ 31^{4}\ 34^{5}$; and the lunar month, $29\,d.\ 12\,h.\ 45'\ 47''\ 26^{3}\ 48^{4}\ 30^{5}$: but Calippus, conſidering that the Metonic quantity of the ſolar year was not exact, multiplied Meton's period by 4, and thence aroſe a period of 76 years, called the *Calippic.* The Calippic period, therefore, contains 2,7759 days: and ſince the lunar cycle contains 235 lunations, and the *Calippic period* is quadruple of this, it contains 940 lunations. This period began in the third year of the 112th Olympiad, or the 4384th of the Julian period. It is demonſtrated, however, that the Calippic period itſelf is not accurate; that it does not bring the new and full moons preciſely to their places: $8\,h.\ 5'\ 52''\ 60'''$, being the exceſs of 940 lunations above 76 ſolar years; but brings them too late, by a whole day in 225 years.

CALISTA, in fabulous hiſtory, the daughter of Lycaon king of Arcadia, and one of the nymphs of

Dianna. Being beloved by Jupiter, that god aſſumed the form of the goddeſs of chaſtity, by which means he debauched her: but her diſgrace being revealed, as ſhe was bathing with her patroneſs, the incenſed deity turned her and the ſon with which ſhe was pregnant into bears; when Jupiter, in compaſſion to her ſufferings, took them up into the heavens, and made them the conſtellations Urſa Major and Urſa Minor.

CALIX. See Calyx.

CALIXTINS, a name given to thoſe, among the Lutherans, who follow the ſentiments of George Calixtus, a celebrated divine, and profeſſor at Helmſtadt, in the duchy of Brunſwick, who died in 1656: he oppoſed the opinion of St Auguſtin, on predeſtination, grace, and free-will, and endeavoured to form an union among the various members of the Romiſh, Lutheran, and reformed churches; or, rather, to join them in the bonds of mutual forbearance and charity.

Calixtins alſo denote a ſect in Bohemia, derived from the Huſſites, about the middle of the 15th century, who aſſerted the uſe of the cup, as eſſential to the euchariſt. And hence their name; which is formed from the Latin *calix*, a cup.

The Calixtins are not ranked by Romaniſts in the liſt of heretics, ſince in the main they ſtill adhered to the doctrine of Rome. The reformation they aimed at terminated in the four following articles. 1. In reſtoring the cup to the laity. 2. In ſubjecting the criminal clerks to the puniſhment of the civil magiſtrate. 3. In ſtripping the clergy of their lands, lordſhips, and all temporal juriſdiction. 4. In granting liberty to all capable prieſts to preach the word of God.

CALKA, a kingdom of Tartary, in Aſia, to the eaſt of Siberia.

CALKING. See Caulking.

CALKINS, the prominent parts at the extremities of a horſe-ſhoe, bent downwards, and forged to a ſort of point.

Calkins are apt to make horſes trip; they alſo occaſion bleymes, and ruin the back ſinews. If faſhioned in form of a hare's ear, and the horn of a horſe's heel be pared a little low, they do little damage; whereas, the great ſquare calkins quite ſpoil the foot.

Calkins are either ſingle or double, that is, at one end of the ſhoe, or at both: theſe laſt are deemed leſs hurtful, as the horſes can tread more even.

CALL, among hunters, a leſſon blown upon the horn, to comfort the hounds.

Call, an Engliſh name for the mineral called Tungſten or Wolfram by the Germans.

Call, among ſailors, a ſort of whiſtle or pipe, of ſilver or braſs, uſed by the boatſwain and his mates to ſummon the ſailors to their duty, and direct them in the different employments of the ſhip. As the call can be ſounded to various ſtrains, each of them is appropriated to ſome particular exerciſe; ſuch as hoiſting, heaving, lowering, veering away, belaying, letting go a tackle, &c. The act of winding this inſtrument is called piping, which is as attentively obſerved by ſailors as the beat of the drum to march, retreat, rally, charge, &c. is obeyed by ſoldiers.

Call, among fowlers, the noiſe or cry of a bird, eſpecially to its young, or to its mate in coupling-time. One method of catching partridges is by the natural call of a hen trained for the purpoſe, which drawing the cocks to her, they are entangled in a net. Different birds require different ſorts of calls; but they are moſt of them compoſed of a pipe or reed, with a little leathern bag or purſe, ſomewhat in form of a bellows; which, by the motion given thereto, yields a noiſe like that of the ſpecies of bird to be taken. The call for partridges is formed like a boat bored through, and fitted with a pipe or ſwan's quill, &c. to be blown with the mouth, to make the noiſe of the cock partridge, which is very different from the call of the hen. Calls for quails, &c. are made of a leathern purſe in ſhape like a pear, ſtuffed with horſe-hair, and fitted at the end with the bone of a cat's, hare's, or coney's leg, formed like a flageolet. They are played, by ſqueezing the purſe in the palm of the hand, at the ſame time ſtriking on the flageolet part with the thumb, to counterfeit the call of the hen-quail.

*Call of the Houſe.* See Calling.



CALLA, Wake-robin, or *Ethiopian Arum:* A genus of the polyandria order, belonging to the gynandria claſs of plants; and in the natural method ranking under the 2d order, *Piperitæ*. The ſpatha is plain; the ſpadix covered with florets; there is no calyx; no petals; and the berries are monoſpermous. Of this there is but one ſpecies. It hath thick, fleſhy, tuberous roots, which are covered with a thin brown ſkin, and ſtrike down many ſtrong fleſhy fibres into the ground. The leaves have footſtalks more than a foot long, which are green and ſucculent. The leaves are ſhaped like the point of an arrow; they are eight or nine inches in length, ending in a ſharp point, which turns backward; between the leaves ariſe the footſtalk of the flower, which is thick, ſmooth, of the ſame colour as the leaves, riſes above them, and is terminated by a ſingle flower, ſhaped like thoſe of the arum, the hood or ſpatha being twiſted at bottom, but ſpreads open at the top, and is of a pure white colour. When the flowers fade, they are ſucceeded by roundiſh fleſhy berries, compreſſed on two ſides, each containing two or three ſeeds. This plant grows naturally at the Cape of Good Hope. It propagates very faſt by offsets, which ſhould be taken off in the latter end of Auguſt, at which time the old leaves decay; for at this time the roots are in their moſt inactive ſtate. They are ſo hardy as to live without any cover in mild winters, if planted in a warm border and dry ſoil; but with a little ſhelter in hard froſt, they may be preſerved in full growth very well.

*Calla-Suſung*, a town of Aſia, in the iſland of Bouton in the Eaſt Indies. It is ſeated about a mile from the ſea, on the top of a ſmall hill ſurrounded with cocoa nut-trees. See Bouton.

CALLAO, a ſtrong town of South America, in Peru. It is the port of Lima, from which it is diſtant about five miles. The town is built on a low flat point of land on the ſea-ſhore. It is fortified; but the fortifications were much damaged by the laſt great earthquake, and have not ſince been repaired. The town is not above nine or ten feet above the level of high-water mark; but the tide does not commonly riſe or fall above five feet. The ſtreets are drawn in a line; but are full of duſt, which is very troubleſome. In a ſquare near the ſea-ſide are the governor's houſe, the viceroy's palace, the pariſh-church, and a battery of three pieces of cannon. On the north ſide are the ware-

warehouses for the merchandise brought from Chili, Mexico, and other parts of Peru. The other churches are built with reeds, and covered with timber or clay, but they look tolerably neat. There are five monasteries and a hospital, though the number of families does not exceed 400. The trade of Callao is considerable. From Chili they bring cordage, leather, tallow, dried fish, and corn; from Chiloe, cedar-planks, woollen manufactures, and carpets; from Peru, sugars, wines, brandy, masts, cordage, timber for shipping, cacao, tobacco, and molasses; from Mexico, pitch, tar, woods for dyeing, sulphur, balsam of Peru, both white and brown, as well as commodities from China. At the port of Callao the watering is easy, but the wood is a mile or two distant. Earthquakes are very frequent in these parts, which have done vast mischief to Lima and Callao. W. Long. 76. 15. S. Lat. 12. 29.

CALLE, (anc. geog.) a town of Hither Spain, situated on an eminence which hangs over the river Durius; whose port was at the mouth of the river. Now *Porto*, *Oporto*, or *Port a Port*.

CALLEN, a town of Ireland, in the county of Kilkenny, and province of Leinster, about ten miles south-west of Kilkenny. W. Long. 7. 22. N. Lat. 52. 25.

CALLICARPA. See JOHNSONIA.

CALLICO, in commerce, a sort of cloth resembling linens, made of cotton. The name is taken from that of Callicut, a city on the coast of Malabar, being the first place at which the Portuguese landed when they discovered the India trade. The Spaniards still call it *callicu*.

Callicoes are of different kinds, plain, printed, painted, stained, dyed, chints, muslins, and the like, all included under the general denomination of *callicoes*. Some of them are painted with various flowers of different colours: others are not stained, but have a stripe of gold and silver quite through the piece, and at each end is fixed a tissue of gold, silver, and silk, intermixed with flowers. The printing of callicoes was first set on foot in London about the year 1676.

CALLICRATES, an ancient sculptor, who engraved some of Homer's verses on a grain of millet, made an ivory chariot that might be concealed under the wing of a fly, and an ant of ivory in which all the members were distinct: but Ælian justly blames him for exerting his genius and talents in things so useless, and at the same time so difficult. He flourished about the year 472 before Christ.

CALLIGONUM, in botany: A genus of the digynia order belonging to the polyandria class of plants; and in the natural method ranking under the 12th order *Holoraceæ*. The calyx is pentaphyllous, without petals or styles; the fruit hispid and monospermous. There is but one species, which is found on Mount Arrarat.

CALLIGRAPHUS anciently denoted a copyist, or scrivener, who transcribed fair, and at length, what the notaries had taken down in notes or minutes. The word is compounded of καλλος, *beauty*, and γραφω, *I write*. The minutes of acts, &c. were always taken in a kind of cypher, or short-hand; such as the notes of Tyro in Gruter; by which means the notaries, as the Latins called them, or the σημειογραφοι and τα χυγραφοι, as the Greeks called them, were enabled to keep pace with a speaker or person who dictated. These notes, being understood by few, were copied over fair, and at length, by persons who had a good hand, for sale, &c. These persons were called *calligraphi*; a name frequently met with in the ancient writers.



CALLIGRAPHY, the art of fair writing. Callicrates is said to have written an elegant distich on a sesamum seed. Junius speaks of a person, as very extraordinary, who wrote the apostles creed, and beginning of St John's Gospel, in the compass of a farthing. What would he have said of the famous Peter Bale, who in 1575 wrote the Lord's prayer, creed, ten commandments, and two short prayers in Latin, with his own name, motto, day of the month, year of the Lord, and reign of the queen, in the compass of a single penny, inchased in a ring and border of gold, and covered with a crystal, all so accurately wrought as to be very legible?

CALLIMACHUS, a celebrated architect, painter, and sculptor, born at Corinth, having seen by accident a vessel about which the plant called *acanthus* had raised its leaves, conceived the idea of forming the Corinthian capital. (See ACANTHUS, and Plate XXXIV. fig 4.) The ancients assure us, that he worked in marble with wonderful delicacy. He flourished about 540 B. C.

CALLIMACHUS, a celebrated Greek poet, native of Cyrene in Libya, flourished under Ptolemy, Philadelphus and Ptolemy Evergetes kings of Egypt, about 280 years before Christ. He passed, according to Quintilian, for the prince of the Greek elegiac poets. His style is elegant, delicate, and nervous. He wrote a great number of small poems, of which we have only some hymns and epigrams remaining. Catullus has closely imitated him, and translated into Lain verse his small poem on the locks of Berenice. Callimachus was also a good grammarian and a learned critic. There is an edition of his remains, by Mess. le Fevre, quarto; and another in two volumes octavo, with notes by Spanhein, Grævius, Bently, &c.

CALLING *the* HOUSE, in the British parliament, is the calling over the members names, every one answering to his own, and going out of the house, in the order in which he is called; this they do in order to discover whether there be any persons there not returned by the clerk of the crown, or if any member be absent without leave of the house.

CALLINICUS of Heliopolis, inventor of a composition to burn in the water, called the *Greek*, and sitince *Wild*, *Fire*. See *Grecian* FIRE.

CALLINUS of Ephesus a very ancient Greek poer, inventor of elegiac verse; some specimens of which are to be found in the collection of Stobeus. He flourished about 776 years before Christ.

CALLIONYMUS, the DRAGONET, in ichthyology, a genus of fishes belonging to the order of jugularies. The upper lip is doubled up; the eyes are very near each other; the membrane of the gills has six radii; the operculum is shut; the body is naked; and the belly-fins are at a great distance from each other. There are three species of callionymus, viz. 1. The lyra, with the first bone of the back-fin as long at the body of the animal, and a cirrhus at the anus. Is is found as far north as Norway and Spitzbergen, and as far

far fouth as the Mediterranean fea, and is not unfrequent on the Scarborough coaft, where it is taken by the hook in 30 or 40 fathoms water. It is often found in the ftomach of the cod-fifh. 2. The dracunculus, with the firft bone of the back-fin fhorter than its body, which is of a fpotted yellow colour. It frequents the fhores of Genoa and Rome. 3. The indicus has a fmooth head, with longitudinal wrinkles; the lower jaw is a little longer than the upper one; the tongue is obtufe and emarginated; the apertures of the gills are large: it is of a livid colour, and the anus is in the middle of the body. It is a native of Afia.

CALLIOPE, in the Pagan mythology, the mufe who prefides over eloquence and heroic poetry. She was thus called from the fweetnefs of her voice, and was reckoned the firft of the nine fifters. Her diftinguifhing office was to record the worthy actions of the living; and accordingly fhe is reprefented with tablets in her hand.

CALLIPÆDIA, the art of getting or breeding fine and beautiful children. We find divers rules and practices relating to this art, in ancient and modern writers. Among the magi, a fort of medicine called *ermefia* was adminiftered to pregnant women, as a means of producing a beautiful iffue. Of this kind were the kernels of pine-nuts ground with honey, myrrh, faffron, palm-wine, and milk. The Jews are faid to have been fo folicitous about the beauty of their children, that care was taken to have fome very beautiful child placed at the door of the public baths, that the women at going out being ftruck with his appearance, and retaining the idea, might all have children as fine as he. The Chinefe take ftill greater care of their breeding women, to prevent uncouth objects of any kind from ftriking their imagination. Muficians are employed at night to entertain them with agreeable fongs and odes, in which are fet forth all the duties and comforts of a conjugal and domeftic life; that the infant may receive good impreffions even before it is born, and not only come forth agreeably formed in body, but well difpofed in mind. Callipædia, neverthelefs, feems to have been firft erected into a juft art by Claude Quillief de Chinon, a French abbot, who under the fictitious name of *Calvidus Lætus*, has publifhed a fine Latin poem in four books, under the title of *Callipædia, feu de pulchræ prolis habendæ ratione;* wherein are contained all the precepts of that new art. There is a tranflation of it into Englifh verfe by Mr Rowe.

CALLIPOLIS, (anc. geog) the name of feveral cities of antiquity, particularly one upon the Hellefpont, next the Propontis, and oppofite to Lampfacus in Afia. Now GALLIPOLI.

CALLIPPIC PERIOD. See CALIPPIC.

CALLIRRHOE, (anc. geog), furnamed *Enneacrunos*, from its nine fprings or channels; a fountain not far from Athens, greatly adorned by Pififtratus, where there were feveral wells, but this the only running fpring. Callirrhoe was alfo the name of a very fine fpring of hot water beyond Jordan near the Dead Sea, into which it empties itfelf.

CALISIA, in botany: A genus of the monogynia, order, belonging to the triandria clafs of plants; and in the natural method ranking under the 6th order, *Enfatæ*. The calyx is triphyllous; the petals are three: the antheræ are double; and the capfule is bilocular. There is but one fpecies, a native of America.

CALLISTEA, in Grecian antiquity, a Lefbian feftival, wherein the women prefented themfelves in Juno's temple, and the prize was affigned to the faireft. There was another of thefe contentions at the feftival of Ceres Eleufinia among the Parrhafians, and another among the Eleans, where the moft beautiful man was prefented with a complete fuit of armour, which he confecrated to Minerva, to whofe temple he walked in proceffion, being accompanied by his friends, who adorned him with ribbons, and crowned him with a garland of myrtle.

CALLISTHENES, the philofopher, difciple and relation of Ariftotle, by whofe defire he accompanied Alexander the Great in his expedition; but proving too fevere a cenfurer of that hero's conduct, he was put by him to the torture (on a fufpicion of a treafonable confpiracy), and died under it, 328 years before Chrift.

CALLISTRATUS, an excellent Athenian orator, was banifhed for having obtained too great an authority in the government. Demofthenes was fo ftruck with the force of his eloquence, and the glory it procured him, that he abandoned Plato, and refolved from thenceforward to apply himfelf to oratory.

CALLITRICHE, or STAR-GRASS, in botany: A genus of the digynia order, belonging to the monandria clafs of plants, and in the natural method ranking under the 12th order, *Holoraceæ*. There is no calyx, but two petals, and the capfule is bilocular and tetrafpermous.

CALLOO, a fortrefs in the Netherlands, in the territory of Waes, on the river Scheld, fubject to the houfe of Auftria. The Dutch were defeated here by the Spaniards in 1638. E. Long. 4. 10. N. Lat. 51. 15,

CALLOSUM CORPUS, in anatomy, a whitifh hard fubftance, joining the two hemifpheres of the brain, and appearing in view when the two hemifphers are drawn back. See ANATOMY, N° 132.

CALLOT (James), a celebrated engraver born at Nancy in 1593. In his youth he travelled to Rome to learn defigning and engraving; and from thence went to Florence, where the grand duke took him into his fervice. After the death of that prince, Callot returned to his native country; when he was very favourably received by Henry duke of Lorrain, who fettled a confiderable penfion upon him. His reputation being foon after fpread all over Europe, the infanta of the Netherlands drew him to Bruffels, where he engraved the fiege of Breda. Louis XIII. made him defign the fiege of Rochelle, and that of the ifle of Rhe. The French king having taken Nancy in 1631, made Callot the propofal of reprefenting that new conqueft, as he had already done the taking of Rochelle: but Callot begged to be excufed; and fome courtiers refolving to oblige him to do it, he anfwered, that he would fooner cut off his thumb than do any thing againft the honour of his prince and country. This excufe the king accepted; and faid, that the duke of Lorrain was happy in having fuch faithful and affectionate fubjects. Callot followed his bufinefs fo clofely, that, though he died at 43 years of age, he is faid to have left of his own

own execution about 1500 pieces. The following are a few of the principal. 1. The *murder of the innocents*, a small oval plate, engraved at Florence. Callot engraved the same subject at Nancy, with some difference in the figures on the back-ground. The former is the most rare: a fine impression of it is very difficult to be found. 2. The *marriage of Cana in Galilee*, from Paolo Veronese, a middling-sized plate lengthwise. 3. The *passion of Christ*, on twelve very small upright plates: first impressions very scarce. 4. *St John in the island of Palma*, a small plate, nearly square. 5. The *temptation of St Anthony*, a middling-sized plate, lengthwise. He also engraved the same subject larger; which, though not the best, is notwithstanding the scarcest print. There is a considerable difference in the treatment of the subject in the two prints. 6. The *punishments*, wherein is seen the execution of several criminals. The marks of the best impressions of this plate are, a small square tower which appears above the houses, towards the left, and a very small image of the Virgin placed in an angle of the wall, near the middle of the print. 7. The *miseries of war*, eighteen small plates, lengthwise. There is another set on the same subject, consisting of seven plates less than the former. 8. The *geat fair of Florence*, so called because it was engraved at Florence. As several parts of this plate were not equally bitten by the aquafortis, it is difficult to meet with a fine impression. Callot, on his return to Nancy, re-engraved this plate without any alteration. The copy, however, is by no means equal to the original. The first is distinguished from the second by the words *in Firenza*, which appear below at the right-hand corner of the plate. The second has these words in the same place, *Fe Florientis, & excudit Nancei.* There is also a large copy of this print, reversed, published by Savery; but the difference is easily distinguished between it and the true print. 9. The *little fair*, otherwise called the *players at bowls;* where also some peasants are represented dancing. This is one of the scarcest of Callot's prints; and it is very difficult to meet with a fine impression of it, for the distances and other parts of the plate failed in the biting it with the aquafortis. 10. The *titling, or the new street at Nancy*, a middling-sized plate, lengthwise. 11. The *Garden of Nancy*, where young men are playing with a balloon, the same. 12. *View of the Port Neuf*, a small plate, lengthwise. 13. *View of the Louvre*, the same. 14. *Four landscapes*, small plates, lengthwise.

CALLUS, or CALLOSITY, in a general sense, any cutaneous, corneous, or osseous hardness, whether natural or preternatural; but most frequently it means the callus generated about the edges of a fracture, provided by nature to preserve the fractured bones, or divided parts, in the situation in which they are replaced by the surgeon. A callus, in this last sense, is a sort of jelly, or liquid viscous matter, that sweats out from the small arteries and bony fibres of the divided parts, and fills up the chinks or cavities between them. It first appears of a cartilaginous substance; but at length becomes quite bony, and joins the fractured part so firmly together, that the limb will often make greater resistance to any external violence with this part than with those which were never broken.

CALLUS is also a hard, dense, insensible knob, rising on the hands, feet, &c. by much friction and pressure against hard bodies.



CALM, the state of rest which appears in the air and sea when there is no wind stirring. A calm is more dreaded by a sea-faring man than a storm if he has a strong ship and sea-room enough; for under the line excessive heat sometimes produces such dead calms, that ships are obliged to stay two or three months without being able to stir one way or other. Two opposite winds will sometimes make a calm. This is frequently observed in the gulph of Mexico, at no great distance from the shore, where some gust or land-wind will so poise the general easterly wind, as to produce a perfect calm.

Calms are never so great on the ocean as on the Mediterranean, by reason the flux and reflux of the former keep the water in a continual agitation, even where there is no wind; whereas there being no tides in the latter, the calm is sometimes so dead, that the face of the water is as clear as a looking-glass; but such calms are almost constant presages of an approaching storm. On the coasts about Smyrna, a long calm is reputed a prognostic of an earthquake.

It is not uncommon for the vessels to be calmed, or becalmed, as the sailors express it, in the road of the constant Levantine winds, in places where they ride near the land. Thus between the two capes of Cartooche toward the main, and cape Antonio in Cuba, the sea is narrow, and there is often a calm produced by some gust of a land-wind, that poises the Levantine wind, and renders the whole perfectly still for two or three days. In this case, the current that runs here is of use to the vessels, if it sets right; when it sets easterly, a ship will have a passage in three or four days to the Havannah; but if otherwise, it is often a fortnight or three weeks sail, the ship being embayed in the gulf of Mexico.

When the weather is perfectly calm, no wind at all stirring, the sailors try which way the current sets, by means of a boat which they send out, and which will ride at anchor though there is no bottom to be found, as regularly and well as if fastened by the strongest anchor to the bottom. The method is this: they row the boat to a little distance from the ship, and then throw over their plummet, which is about forty pounds weight; they let this sink to about two hundred fathom; and then, though it never reaches the bottom, the boat will turn head against the current, and ride as firmly as can be.

*CALM Latitudes*, in sea language, are situated in the Atlantic ocean, between the tropic of Cancer and the latitude of 29° N. or they denote the space that lies between the trade and variable winds, because it is frequently subject to calms of long duration.

CALMAR, a strong sea-port of Sweden, in the province of Smaland, divided into two towns, the old and the new; but of the former there remains only the church and a few houses. The new town is built a little way from the other, and has large handsome houses. E. Long. 16. 15. N. Lat. 56. 48.

CALMET (Augustine), one of the most learned and laborious writers of the 18th century, was born at Mesnil le Horgne, a village in the diocese of Toul in France, in the year 1672, and took the habit of the

Bene-

Benedictines in 1688. Among the many works he published are, 1. A literal exposition, in French, of all the books in the Old Testament, in nine volumes folio. 2. An historical, critical, chronological, geographical, and literal, dictionary of the Bible, in four vols folio, enriched with a great number of figures of Jewish antiquities. 3. A civil and ecclesiastical history of Lorrain, three vols folio. 4. A history of the Old and New Testament, and of the Jews, in two volumes folio, and seven vols duodecimo. 5. An universal sacred and profane history, in several volumes quarto. He died in 1757.

CALMUCKS. See KALMUCKS.

CALNE, a town of Wiltshire in England, seated on a river of the same name. It has a handsome church, and sends two members to parliament. W. Long. 1. 59. N. Lat. 51. 30.

CALNEH, (anc. geog.) a city in the land of Shinar, built by Nimrod, and the last city mentioned (Gen. x. 10.) as belonging to his kingdom. It is believed to be the same with Calno mentioned in Isaiah (x. 9.), and with Canneh in Ezekiel (xxvii. 23.) with still greater variation. It is observed, that it must have been situated in Mesopotamia, since these prophets join it with Haran, Eden, Assyria, and Chilmad, which carried on a trade with Tyre. It is said by the Chaldee interpreters, as also by Eusebius and Jerom, to be the same with Ctesiphon, standing upon the Tigris, about three miles distant from Selecucia, and that for some time it was the capital city of the Parthians.

CALOGERI, in church-history, monks of the Greek church, divided into three degrees: the novices, called *archari*; the ordinary professed, called *microchemi*; and the more perfect, called *megalochemi*: they are likewise divided into cænobites, anchorets, and recluses. The cænobites are employed in reciting their offices from midnight to sun-set; they are obliged to make three genuflexions at the door of the choir, and, returning, to bow to the right and to the left, to their brethren. The anchorites retire from the conversation of the world, and live in hermitages in the neighbourhood of the monasteries; they cultivate a little spot of ground, and never go out but on Sundays and holidays to perform their devotions at the next monastery. As for the recluses, they shut themselves up in grottos and caverns on the tops of mountains, which they never go out of, abandoning themselves entirely to Providence: they live on the alms sent them by the neighbouring monasteries.

CALOMEL, or dulcified sublimate of mercury. See PHARMACY, *Index*.

CALOPHYLLUM, in botany: A genus of the monogynia order belonging to the polyandria class of plants: and in the natural method classed under those called *doubtful* by Linnæus. The corolla is tetrapetalous; the calyx tetraphyllous and coloured; the fruit a globose plum. There are two species, both natives of India.

CALOTTE, a cap or coif of hair, sattin, or other stuff; an ecclesiastical ornament in most Popish countries. See CAP.

CALOTTE, in architecture, a round cavity or depressure, in form of a cap or cup, lathed and plastered, used to diminish the rise or elevation of a moderate chapel, cabinet, alcove, &c. which, without such an expedient, would be too high for other pieces of the apartment.



CALPE, a mountain of Andalusia in Spain; at the foot of which, towards the sea, stands the town of Gibraltar. It is half a league in height towards the land, and so steep that there is no approaching it on that side.

CALPURNIUS, (Titus), a Latin Sicilian poet, lived under the emperor Carus and his son. We have seven of his eclogues remaining.

CALQUING, or CALKING, a term used in painting, &c. where the back-side of any thing is covered over with a black or red colour, and the strokes or lines traced through on a waxed plate, wall, or other matter, by passing lightly over each stroke of the design with a point, which leaves an impression of the colour on the plate or wall.

CALTHA, in botany: A genus of the monogynia order belonging to the polyandria class of plants; and in the natural method ranking under the 26th order, *Multisiliquæ*. There is no calyx; there are five petals; no nectaria; the capsules are many, and polyspermous. There is only one species known, which grows naturally in moist boggy lands in many parts of England and Scotland. There is a variety, with very double flowers, which for its beauty is preserved in gardens. It is propagated by parting the roots in autumn. It should be planted in a moist soil and shady situation; and as there are often such places in gardens where few other plants will thrive, so these may be allowed room, and during their season of flowering will afford an agreeable variety. The flowers gathered before they expand, and preserved in salted vinegar, are a good substitute for capers. The juice of the petals, boiled with a little allum, stains paper yellow. The remarkable yellowness of the butter in spring is supposed to be caused by this plant: but cows will not eat it, unless compelled by extreme hunger; and then, Boerhaave says, it occasions such an inflammation, that they generally die. Upon May-day, the country people strew the flowers upon the pavement before their doors. Goats and sheep eat this plant; horses, cows, and swine refuse it.

CALTROP, in botany. See TRIBULUS.

CALTROP, in military affairs, an instrument with four iron points, disposed in a triangular form, so that three of them are always on the ground, and the fourth in the air. They are scattered over the ground where the enemy's cavalry is to pass, in order to embarrass them.

CALVARIA, in anatomy, the hairy scalp or upper part of the head, which, either by disease or old age, grows bald first.

CALVART (Denis), a celebrated painter, was born at Antwerp in 1552; and had for his masters Prospero Fontana and Lorenzo Sabbatini. He opened a school at Bologna, which became celebrated; and from which proceeded Guido, Albani, and other great masters. Calvart was well skilled in architecture, perspective, and anatomy, which he considered as necessary to a painter, and taught them to his pupils. His principal works are at Bologna, Rome, and Reggio. He died at Bologna in 1619.

CALVARY, a term used in Catholic countries for a a kind of chapel of devotion raised on a hillock near a city, in memory of the place where Jesus Christ was crucified near the city of Jerusalem. The word comes from the Latin *calvarium;* and that from *calvus*, bald; in regard the top of that hillock was bare and destitute of verdure: which is also signified by the Hebrew word *golgotha*. Such is the Calvary of St Valerian near Paris; which is accompanied with several little chapels, in each of which is represented in sculpture one of the mysteries of the passion.

Calvary, in heraldry, a cross so called, because it resembles the cross on which our Saviour suffered. It is always set upon steps.

CALVERT, (George) afterwards lord Baltimore, was born at Kipling in Yorkshire about the year 1582, and educated at Oxford, where he took the degree of bachelor of arts, and afterwards travelled. At his return, he was made secretary to Sir Robert Cecil: he was afterwards knighted, and in 1618 appointed one of the principal secretaries of state. But after he had enjoyed that post about five years, he willingly resigned it; freely owning to his majesty that he was become a Roman-catholic, so that he must either be wanting to his trust, or violate his conscience in discharging his office. This ingenuous confession so affected king James, that he continued him privy-counsellor all his reign, and the same year created him baron of Baltimore in the kingdom of Ireland. He had before obtained a patent for him and his heirs, for the province of Avelon in Newfoundland: but that being exposed to the insults of the French, he abandoned it, and afterwards obtained the grant of a country on the north part of Virginia from Charles I. who called it *Maryland*, in honour of his queen: but he died in April 1632 (aged 50), before the patent was made out. It was, however, filled up to his son Cecil Calvert lord Baltimore; and bears date June 20th, 1632. It is held from the crown as part of the manor of Windsor, on one very singular condition, viz. to present two Indian arrows yearly, on Easter Tuesday, at the castle, where they are kept and shown to visitors.—His lordship wrote, 1. A Latin poem on the death of Sir Henry Upton. 2. Speeches in parliament. 3. Various letters of state. 4. The answer of Tom Tell-truth. 5. The practice of princes. And, 6. The lamentation of the kirk.

CALVI, a town of the province of Lavoro, in the kingdom of Naples, situated near the sea, about fifteen miles north of the city of Naples. E. Long. 14. 45. N. Lat. 41. 15.

Calvi is also the name of a sea-port in the island of Corsica, situated on a bay, on the west side of the island, about 40 miles south-west of Bastia. E. Long. 9. 5. N. Lat. 42. 16.

CALVIN (John), the celebrated reformer of the Christian church from Romish superstitions and doctrinal errors, and founder of the sect since called *Calvinists*, was born in 1509. He was the son of a cooper of Noyon in Picardy; and his real name was *Chauvin*, which he chose to latinize into *Calvinus*, styling himself in the title-page to his first work (a Commentary on *Seneca de clementia*), "Lucius Calvinus, Civis Romanus;" an early proof of his pride, at about 24 years of age. In 1529, he was rector of Pont l'Eveque; and in 1534, he threw up this benefice, separating himself



entirely from the Romish church. The persecution against the Protestants in France (with whom he was now associated) obliged him to retire to Basle in Switzerland: here he published his famous Institutes of the Christian religion in 1535. The following year, he was chosen professor of divinity, and one of the ministers of the church, at Geneva. The next year, *viz.* 1537, he made all the people solemnly swear to a body of doctrines; but finding that religion had not yet had any great influence on the morals of the people, he, assisted by other ministers, declared, that since all their admonitions and warnings had proved unsuccessful, they could not celebrate the holy sacrament as long as these disorders reigned; he also declared, that he could not submit to some regulations made by the synod of Berne. Upon which the Syndics having summoned the people, it was ordered that Calvin and two other ministers should leave the city within two days. Upon this Calvin retired to Strasburg, where he established a French church, of which he was the first minister, and was also chosen professor of divinity there. Two years after he was chosen to assist at the diet appointed by the emperor to meet at Worms and at Ratisbon in order to appease the troubles occasioned by the difference of religion. He went with Bucer, and entered into a conference with Melancton. The people of Geneva now entreated him to return; to which he consented, and arrived at Geneva, September 13th 1541. He began with establishing a form of ecclesiastical discipline, and a consistorial jurisdiction, with the power of inflicting all kinds of canonical punishments. This was greatly disliked by many persons, who imagined that the papal tyranny would soon be revived. Calvin, however, asserted on all occasions the rights of his consistory with inflexible strictness; and he caused Michael Servetus to be burnt at the stake for writing against the doctrine of the Trinity. But though the rigour of his proceedings sometimes occasioned great tumults in the city, yet nothing could shake his steadiness and inflexibility. Amongst all the disturbances of the commonwealth, he took care of the foreign churches in England, France, Germany, and in Poland; and did more by his pen than his presence, sending his advice and instructions by letter, and writing a great number of books. This great reformer died on the 27th of May 1564, aged 55. His works were printed together at Amsterdam in 1671, in nine volumes folio: the principal of which are his Institutions, in Latin, the best edition of which is that of Robert Stephens in 1553, in folio; and his Commentaries on the Holy Scriptures.—Calvin is universally allowed to have had great talents, an excellent genius, and profound learning. His style is grave and polite. Independent of his spiritual pride, his morals were exemplary; for he was pious, sober, chaste, laborious, and disinterested. But his memory can never be purified from the stain of burning Servetus: it ill became a reformer to adopt the most odious practice of the corrupt church of Rome.

CALVINISM, the doctrine and sentiments of Calvin and his followers. Calvinism subsists in its greatest purity in the city of Geneva; and from thence it was first propagated into Germany, France, the United Provinces, and England. In France it was abolished by the revocation of the edict of Nantz in 1685.

It has been the prevailing religion in the United Provinces ever since the year 1571. The theological system of Calvin was adopted, and made the public rule of faith in England, under the reign of Edward VI. and the church of Scotland was modelled by John Knox, the disciple of Calvin, agreeably to the doctrine, rites, and form of ecclesiastical government established at Geneva. In England it has declined since the time of queen Elizabeth; though it still subsists, some say a little allayed, in the articles of the established church; and in its rigour in Scotland.

The distinguishing theological tenets of Calvinism, as the term is now generally applied, respect the doctrines of PREDESTINATION, or particular ELECTION and REPROBATION, original SIN, particular REDEMPTION, effectual, or, as some have called it, irresistible GRACE in regeneration, JUSTIFICATION by faith, PERSEVERANCE, and the TRINITY. See each of these articles.

Besides the doctrinal part of Calvin's system, which, so far as it differs from that of other reformers of the same period, principally regarded the absolute decree of God, whereby the future and eternal condition of the human race was determined out of mere sovereign pleasure and free-will; it extended likewise to the discipline and government of the Christian Church, the nature of the Eucharist, and the qualification of those who were entitled to the participation of it. Calvin considered every church as a separate and independent body, invested with the power of legislation for itself. He proposed that it should be governed by presbyteries and synods composed of clergy and laity, without bishops, or any clerical subordination; and maintained, that the province of the civil magistrate extended only to its protection and outward accommodation. In order to facilitate an union with the Lutheran church, he acknowledged a real, though spiritual, presence of Christ, in the Eucharist, that true Christians were united to the man Christ in this ordinance, and that divine grace was conferred upon them, and sealed to them, in the celebration of it; and he confined the privilege of communion to pious and regenerate believers. In France the Calvinists are distinguished by the name of *Huguenots;* and, among the common people, by that of *Parpaillots*. In Germany they are confounded with the Lutherans, under the general title *Protestants;* only sometimes distinguished by the name *Reformed*.

CALVINISTS, in chrch-history, those who follow the opinions of CALVIN. See the two preceding articles.

*Crypto-CALVINISTS*, a name given to the favourers of Calvinism in Saxony, on account of their secret attachment to the Genevan doctrine and discipline. Many of them suffered by the decrees of the convocation of Torgaw, held in 1576. The Calvinists in their progress have divided into various branches, or lesser sects.

CALVISIUS, (Seth) a celebrated German chronologer in the beginning of the 17th century. He wrote *Elenchus calendarii Gregoriani, et duplex calendarii melioris forma*, and other learned works, together with some excellent treatises on music. He died in 1617, aged 61.

CALVITIES, or CALVITIUM, in medicine, baldness, or a want of hair, particularly on the sinciput, occasioned by the moisture of the head, which should feed it, being dried up, by some disease, old age, or the immoderate use of powder, &c. See ALOPECIA.



CALUMET, a symbolical instrument of great importance among the American Indians.—It is nothing more than a pipe, whose bowl is generally made of a soft red marble, the tube of a very long reed, ornamented with the wings and feathers of birds. No affair of consequence is transacted without the calumet. It ever appears in meetings of commerce or exchanges; in congresses for determining of peace or war; and even in the very fury of a battle. The acceptance of the calumet is a mark of concurrence with the terms proposed; as the refusal is a certain mark of rejection. Even in the rage of a conflict this pipe is sometimes offered; and if accepted, the weapons of destruction instantly drop from their hands, and a truce ensues. It seems the sacrament of the savages; for no compact is ever violated which is confirmed by a whiff from this holy reed. When they treat of war, the pipe and all its ornaments are usually red, or sometimes red only on one side. The size and decorations of the calumet are for the most part proportioned to the quality of the persons to whom they are presented, and to the importance of the occasion. The calumet of peace is different from that of war. They make use of the former to seal their alliances and treaties, to travel with safety, and to receive strangers; but of the latter to proclaim war. It consists of a red stone, like marble, formed into a cavity resembling the head of a tobacco pipe, and fixed to a hollow reed. They adorn it with feathers of various colours; and name it the calumet of the sun, to which luminary they present it, in expectation of thereby obtaining a change of weather as often as they desire. From the winged ornaments of the calumet and its conciliating uses, writers compare it to the caduceus of Mercury, which was carried by the caduceatores, or messengers of peace, with terms to the hostile states. It is singular, that the most remote nations, and the most opposite in their other customs and manners, should in some things have, as it were, a certain consent of thought. The Greeks and the Americans had the same idea, in the invention of the caduceus of the one, and the calumet of the other.

*Dance of the CALUMET*, is a solemn rite among the Indians on various occasions. They dare not wash themselves in rivers in the beginning of summer, nor taste of the new fruits, without performing it; and the same ceremony always confirms a peace or precedes a war. It is performed in the winter-time in their cabins, and in summer in the open fields. For this purpose they choose a spot among trees to shade them from the heat of the sun, and lay in the middle a large mat, as a carpet, setting upon it the monitor, or god, of the chief of the company. On the right hand of this image they place the calumet, as their great deity, erecting around it a kind of trophy with their arms. Things being thus disposed, and the hour of dancing come, those who are to sing take the most honourable seats under the shade of the trees. The company is then ranged round, every one before he sits down, saluting the monitor, which is done by blowing upon

upon it the smoke of their tobacco. Each person next receives the calumet in rotation, and holding it with both hands, dances to the cadence of the vocal music, which is accompanied with the beating of a sort of drum. During this exercise, he gives a signal to one of their warriors, who takes a bow, arrow, and axe, from the trophies already mentioned, and fights him; the former defending himself with the calumet only, and both of them dancing all the while. This mock engagement being over, he who holds the calumet makes a speech, in which he gives an account of the battles he has fought, and the prisoners he has taken, and then receives a cloak, or some other present, from the chief of the ball. He then resigns the calumet to another, who having acted a similar part, delivers it to a third, who afterwards gives it to his neighbour, till at last the instrument returns to the person that began the ceremony, who presents it to the nation invited to the feast, as a mark of their friendship, and a confirmation of their alliance, when this is the occasion of the entertainment.

CALUMNY, the crime of accusing another falsely, and knowingly so, of some heinous offence.

*Oath of* CALUMNY, *Juramentum* (or rather *Jusjurandum*) *Calumniæ*, among civilians and canonists, was an oath which both parties in a cause were obliged to take: the plaintiff that he did not bring his charge, and the defendant that he did not deny it, with a design to abuse each other, but because they believed their cause was just and good; that they would not deny the truth, nor create unnecessary delays, nor offer the judge or evidence any gifts or bribes. If the plaintiff refused this oath, the complaint or libel was dismissed; if the defendant, it was taken *pro confesso*. This custom was taken from the ancient athletæ; who, before they engaged, were to swear that they had no malice, nor would use any unfair means for overcoming each other. The *juramentum calumniæ* is much disused, as a great occasion of perjury. Anciently the advocates and proctors also took this oath; but of late it is dispensed with, and thought sufficient that they take it once for all at their first admission to practice. See also LAW, Part III. n° clxxxiv. 7.

CALVUS (Cornelius Licinius), a celebrated Roman orator, was the friend of Catullus; and flourished 64 B. C. Catullus, Ovid, and Horace, speak of him.

CALX properly signifies *lime*, but is also used by chemists and physicians for a fine powder remaining after the calcination or corrosion of metals and other mineral substances. All metallic calces, at least all those made by fire, are found to weigh more than the metal from which they were originally produced. See the article FIRE.

CALX *Nativa*, in natural history, a kind of marly earth, of a dead whitish colour, which, if thrown into water, makes a considerable bubbling and hissing noise, and has, without previous burning, the quality of making a cement like lime or plaster of Paris.

CALX *Viva*, or *Quick-lime*, that whereon no water has been cast, in contradistinction to lime which has been slaked by pouring water on it.

CALYBITES, the inhabitants of a cottage, an appellation given to divers saints on account of their long residence in some hut, by way of mortification. The word is formed from καλυπτω, *tego, I cover*; whence καλυϐη, *a little cot*.—The Romish church commemorates St John the calybites on the 15th of December.



CALYCANTHEMÆ, in botany, an order of plants in the *Fragmenta methodi naturalis* of Linnæus, in which are the following genera, viz. epilopium, œnothera, jussiæa, ludivigia, oldenlandia, isnarda, &c. See BOTANY, sect. vi. 17.

CALYCANTHUS, in botany: A genus of the polygynia order, belonging to the icosandria class of plants; and in the natural method classed with those of which the order is doubtful. The calyx is monophyllous, urceolate, or blown up; squarrose, or frizzled with small coloured leaves, the corolla consisting of the leaves on the calyx; the styles are numerous, each with a glandular stigma; the seeds are many, each with a train, within a succulent calyx. There are two species; namely, 1. The præcox, which is not quite inured to England; and, 2. The floridus, a flowering calycanthus, or Carolina alspice tree, a native of Carolina. It seldom grows, in Britain, to more than five feet high. It divides into many branches irregularly near the ground. They are of a brown colour, and being bruised emit a most agreeable odour. The leaves that garnish this delightful aromatic are of an oval figure, pointed: They are near four inches long, and are at least two and a half broad, and are placed opposite by pairs on the branches. At the end of these stand the flowers, of a kind of chocolate-purple colour, and which are possessed of the opposite qualities of the bark on the branches. They stand single on their short footstalks, come out in May and June, and are succeeded by ripe seeds in England. The propagation of this shrub is not very difficult; though more than common care must be taken, after small plants are obtained, to preserve them till they are of a size to be ventured abroad. The last year's shoots, if laid in the ground, the bark especially being a little bruised, will strike root within the compass of twelve months, particularly if the layers are shaded, and now and then watered in the summer's drought. In the spring they should be taken off, and planted in pots; and if these are afforded a small degree of heat in a bed, they will strike so much the sooner and stronger. After they have been in this bed a month or six weeks, they should be taken out. In the heat of the summer they should be placed in the shade; and if the pots are plunged into the natural ground, it will be so much the better. At the approach of the succeeding winter's bad weather, the pots should be removed into the green-house, or some shelter, and in the spring may resume their old stations: and this should be repeated till they are of a proper size and strength to be planted out to stand. If the pots in which they were first planted were small, they may be shifted into larger a spring or two after; and, when they have got to be pretty strong plants, they may be turned out, mould and all, into the places where they are to remain. By this care of potting them, and housing them during the severe weather in winter, the young crop will be preserved; otherwise, if they were planted immediately abroad, the first hard frost the ensuing winter would destroy them all: Tanner's bark about their roots will be the most proper security;

security; as they are at best, when full grown, but tender plants, and must have the warmest situation and the driest soil.

CALYCIFLORÆ, in botany, the 16th order in Linnæus's *Fragmenta methodi naturalis*, consisting of plants which, as the title imports, have the stamina (the flower) inserted into the calyx. This order contains the following genera, viz. eleagnus, hippophae, osyris, and trophis. See BOTANY, sect. vi. 16.

CALYCISTÆ (from *calyx* the flower-cup), systematic botanists, so termed by Linnæus, who have arranged all vegetables from the different species, structure, and other circumstances, of the calyx or flower-cup. The only systems of this kind are the *Character plantarum novus*, a posthumous work of Magnolius, professor of botany at Montpelier, published in 1720; and Linnæus's *Methodus calycina*, published in his *Classes plantarum*, at Leyden, in 1738. See BOTANY, p. 425.

CALYDON, (anc. geog.), a town of Æolia, situated seven miles and a half from the sea, and divided by the river Evenus: the country was anciently called *Æolis*, from the Æolians its inhabitants. This country was famous for the story of Meleager and the Calydonian boar.

CALYPSO, in fabulous history, a goddess, who was the daughter of Oceanus and Tethys, or, as others say, of Atlas. She was queen of the island of Ogygia, which from her was called the island of *Calypso*. According to Homer, Ulysses suffered shipwreck on her coast, and staid with her several years.

CALYPTRA, among botanists, a thin membranaceous involucrum, usually of a conic figure, which covers the parts of fructification. The capsules of most of the mosses have calyptræ.

CALYX, among botanists, a general term expressing the cup of a flower, or that part of a plant which surrounds and supports the other parts of the flower.

The cups of flowers are very various in their structure, and on that account distinguished by several names, as *perianthium*, *involucrum*, *spatha*, *gluma*, &c. See BOTANY, p. 439.

CALZADA, a town of Old Castile in Spain, seated on the river Leglera. W. Long 2. 47. N. Lat. 42. 12.

CAMÆA, in natural history, a genus of the semipellucid gems approaching to the onyx structure, being composed of zones, and formed on a chrystalline basis; but having their zones very broad and thick, and laid alternately one on another, with no common matter between; usually less transparent, and more debased with earth, than the onyxes.

1. One species of the camæa is the dull-looking onyx, with broad black and white zones; and is the camæa of the moderns, and the Arabian onyx. This species is found in Egypt, Arabia, Persia, and the East Indies. 2. Another species of the camæa is the dull broad zoned, green and white camæa, or the jaspi-cameo of the Italians: it is found in the East Indies, and in some parts of America. 3. The third is the hard camæa, with broad white and chesnut coloured veins. 4. The hard camæa, with bluish, white, and flesh-coloured broad veins, being the sardonyx of Pliny's time, only brought from the East Indies.

CAMAIEU, or CAMAYEU, a word used to express a peculiar sort of onyx: also by some to express a



stone, whereon are found various figures, and representations of landscapes, &c. formed by a kind of *lusus naturæ*; so as to exhibit pictures without painting. The word comes from *camehuia*, a name the Orientals give to the onyx, when they find, in preparing it, another colour; as who should say, *a second stone*. It is of these *camaieux* Pliny is to be understood when he speaks of the manifold picture of gems, and the party-coloured spots of precious stones: *Gemmarum pictura tam multiplex, lapidumque tam discolores maculæ*.

CAMAIEU is also applied by others to those precious stones, as onyxes, cornelians, and agates, whereon the lapidaries employ their art to aid nature, and perfect those representations. See CAMÆA.

CAMAIEU is also frequently applied to any kind of gem, whereon figures may be engraven either indentedly or in relievo. In this sense the lapidaries of Paris are called in their statutes, *cutters of camayeux*.

A society of learned men at Florence undertook to procure all the *cameos* or *camayeux*, and intaglios in the great duke's gallery to be engraven; and began to draw the heads of divers emperors in *cameos*.

CAMAIEU is also used for a painting, wherein there is only one colour; and where the lights and shadows are of gold, wrought on a golden or azure ground. When the ground is yellow, the French call it *cirage*; when grey, *grissaile*. This kind of work is chiefly used to represent basso relievos: the Greeks call pieces of this sort μονοχρωματα.

CAMALDULIANS, CAMALDUNIANS, or CAMALDOLITES, an order of religious, founded by Romuald, an Italian fanatic, in 1023, in the horrible desart of Camaldoli, otherwise called Campo-Malduli, situate in the state of Florence, on the Apennines. Their rule is that of St Benedict; and their houses, by the statutes, are never to be less than five leagues from cities. The *Camaldulians* have not borne that title from the beginning of their order; till the close of the eleventh century they were called *Romualdins*, from the name of their founder. Till that time, *Camaldulian* was a particular name for those of the desart Camaldoli; and D. Grandi observes, was not given to the whole order, in regard it was in this monastery that the order commenced, but because the regulation was best maintained here.

Guido Grandi, mathematician of the great duke of Tuscany, and a monk of this order, has published *Camaldulian* Dissertations, on the origin and establishment of it.

The *Camaldolites* were distinguished into two classes, of which the one were COENOBITES, and the other EREMITES.

CAMALODUNUM (anc. geog.), a town of the Trinobantes, the first Roman colony in Britain, of veterans, under the emperor. From the Itineraries it appears to have stood where now Malden stands. It continued to be an open place under the Romans; a place of pleasure rather than strength; yet not unadorned with splendid works, as a theatre and a temple of Claudius: which the Britons considered as badges of slavery, and which gave rise to several seditions and commotions. It stands on a bay of the sea, at the mouth of the Chelmer, in the county of Essex; the modern name is curtailed from the ancient.

CAMARANA, an island of Arabia, in the Red Sea, whose inhabitants are little and black. It is the best

best of all the islands in this sea, and here they fish for coral and pearls. N. Lat. 15. 0.

CAMASSEI, or CAMACE, (Andrea), painter of history and landscape, was born at Bevagna, and at first learned the principles of design and colouring from Domenichino; but afterwards he studied in the school of Andrea Sacchi, and proved a very great painter. He was employed in St Peter's at Rome, as also at John Lateran; and his works are extremely admired, for the sweetness of his colouring, the elegance of his thoughts and design, and likewise for the delicacy of his pencil. Sandrart laments that the world was deprived of so promising a genius, in the very bloom of life, when his reputation was daily advancing. He died in 1657. At St John Lateran are to be seen, the Battle of Constantine and Maxentius; and the Triumph of Constantine; which are noble and grand compositions; and they afford sufficient proofs of the happiness of his invention and the correctness of his execution. Also at Wilton, the seat of the earl of Pembroke, there is a picture of Venus with the Graces, said to be by the hand of Camassei.

CAMARCUM, (anc. geog.), the capital of the Nervii, a people of Gallia Belgica, (Antonine, Peutinger); before whose time no mention was made of it. Now Cambray, capital of the Cambresis, in French Flanders. E. Long. 3. 15. N. Lat. 50. 15.

CAMARINA, (anc. geog.) a city of Sicily, built by the Syracusans on an eminence near the sea, in the south of Sicily, to the west of the promontory Pachynum, between two rivers, the Hipparis and Oanus. Of so famous a city nothing now remains but its name and ancient walls, a mile and a half in compass, with the slight remains of houses: now called *Camarana*.

*CAMARINA Palus*, a marsh or lake, near the city Camarina, and from which it took its name. In a time of drought, the stench of the lake produced a pestilence; upon which the inhabitants consulted the oracle, whether they should not quite drain it. The oracle dissuaded them: they notwithstanding drained it, and opened a way for their enemies to come and plunder their city: hence the proverb, *Ne moveas Camarinam*, that is, not to remove one evil to bring on a greater. Now *Lago di Camarana*, situate in a beautiful plain, under the very walls of Camarina, and of a triangular form.

CAMAYEU. See CAMAIEU.

CAMBAIA, or CAMPAY, a town of Asia, in India, and in the peninsula on this side the Ganges; capital of a province of the same name; but more commonly called *Guzarat*. It is seated at the bottom of a gulph of the same name, on a small river; is a large place with high walls, and has a pretty good trade. The product and manufactures are inferior to few towns in India; for it abounds in corn, cattle, and silk; and cornelian and agate stones are found in its rivers. The inhabitants are noted for embroidery; and some of their quilts have been valued at 40l. It is subject to the Great Mogul. E. Long. 72. 15. N. Lat. 22. 30.

CAMBAYES, in commerce, cotton cloths made at Bengal, Madras, and some other places on the coast of Coromandel. They are proper for the trade of Marseilles, whither the English at Madras send great numbers of them. Many are also imported into Holland.



CAMBER, according to monkish historians, one of the three sons of Brute, who, upon his father's death, had that part of Britain assigned him for his share, called from him *Cambria*, now *Wales*.

*CAMBER-Beam*, among builders, a piece of timber in an edifice cut archwise, or with an obtuse angle in the middle, commonly used in platforms, as church-leads, and on other occasions where long and strong beams are required.

CAMBERED-DECKS, among ship-builders. The deck or flooring of a ship is said to be cambered, or to lie cambering, when it is higher in the middle of the ship's length, and droops toward the stem and stern, or the two ends. Also when it lies irregular; a circumstance which renders the ship very unfit for war.

CAMBERT, a French musician in the 17th century, was at first admired for the manner in which he touched the organ, and became superintendant of the music to Anne of Austria the queen-mother. The abbe Perrin associated him in the privilege he obtained of his majesty, of setting up an opera in 1669. Cambert set to music two pastorals, one entitled *Pomona*; the other *Ariadne*, which were the first operas given in France. He also wrote a piece entitled *The pains and pleasures of love*. These pieces pleased the public; yet in 1672, Lully obtaining the privilege of the opera, Cambert was obliged to go to England, where he became superintendant of the music to king Charles II. and died there in 1677.

CAMBIO, an Italian word which signifies *exchange*; commonly used at Provence, and in some other countries, particularly Holland.

CAMBIST, a name given in France to those who trade in notes and bills of exchange. The word cambist, though a term of antiquity, is even now a technical word, of some use among merchants, traders, and bankers. Some derive it from the Latin *cambium*, or rather *cambio*.

CAMBLET, or CHAMBLET, a stuff sometimes of wool, sometimes silk, and sometimes hair, especially that of goats, with wool or silk: in some, the warp is silk and wool twisted together, and the woof hair.

The true or oriental camblet is made of the pure hair of the sort of goat, frequent about Angora, and which makes the riches of that city, all the inhabitants whereof are employed in the manufacture and commerce of camblets. It is certain we find mentioned in middle-age writers of stuffs made of camel's hair, under the denominations of *cameletum* and *camelinum*, whence probably the origin of the term; but these are represented as strangely coarse, rough, and prickly, and seem to have been chiefly used among the monks by way of mortification, as the hair-shirt of later times.

We have no camblets made in Europe of the goats hair alone; even at Brussels, they find it necessary to add a mixture of woollen thread.

England, France, Holland, and Flanders, are the chief places of this manufacture. Brussels exceeds them all in the beauty and quality of its camblets: those of England are reputed the second.

*Figured CAMBLETS*, are those of one colour, whereon are stamped various figures, flowers, foliage, &c. by means of hot irons, which are a kind of moulds, passed together with the stuff, under a press. These are chiefly ly brought from Amiens and Flanders: the commerce of these was anciently much more considerable than at present.

*Watered-Camblets*, those which, after weaving, receive a certain preparation with water; and are afterwards passed under a hot-press, which gives them a smoothness and lustre.

*Waved-Camblets*, are those whereon waves are impressed, as on tabbies; by means of a calender under which they are passed and repassed several times.

The manufacturers, &c. of camblets are to take care they do not acquire any false and needless plaits; it being almost impossible to get them out again. This is notorious, even to a proverb: we say, a person is like camblet, he has taken his plait.

CAMBODIA, a kingdom of Asia, in the East-Indies, bounded on the north by the kingdom of Laos, on the east by Cochin-China and Chiapa, and on the south and west by the gulph and kingdom of Siam; divided by a large river called *Mecon*. The capital town is of the same name, seated on the western shore of the said river, about 150 miles north of its mouth. This country is annually overflowed in the rainy season, between June and October; and its productions and fruits are much the same with those usually found between the tropics. E. Long. 104. 15. N. Lat. 12. 40.

CAMBODUNUM, (Itinerary); a town of the Brigantes, in Britain; now in ruins, near Almonbury, in York-shire. Westchester, (Talbot.) Also a town of Vindelicia, on the Cambus: now Kempten, in Suabia.

CAMBOGIA, in botany: A genus of the monogynia order, belonging to the polyandria class of plants; and in the natural method ranking under the 38th order, *Tricoccæ*. The corolla is tetrapetalous; the calyx tetraphyllous; and the fruit is a pome with eight cells, and solitary seeds. There is but one species, the gutta, a native of India, which yields the gum-resin known by the name of *gamboge* in the shops. See Gamboge.

CAMBRASINES, in commerce, fine linen made in Egypt, of which there is a considerable, trade at Cairo, Alexandria, and Rosetta, or Raschit. They are called *cambrasines* from their resemblance to cambrics.

CAMBRAY, an archiepiscopal city, the capital of the Cambresis, in the Low Countries, seated on the Scheld. It is defended by good fortifications, and has a fort on the side of the river; and as the land is low on that side, they can lay the adjacent parts under water by means of sluices. Its ditches are large and deep, and those of the citadel are cut into a rock. Clodion became master of Crambray in 445. The Danes burnt it afterwards; since which time it became a free imperial city. It has been the subject of contest between the emperors, the kings of France, and the earls of Flanders. Francis I. let it remain neutral during the war with Charles V. but this last took possession of it in 1543. After this it was given to John of Montluc by Henry III. of France, whom he created prince of Crambray; but the Spaniards took it from Montluc in 1593, which broke his heart. It continued under the dominion of the House of Austria till 1677, when the king of France became master of it, in whose hands it has continued ever since.

The buildings of Cambray are tolerably handsome, and the streets fine and spacious. The place or square for arms is of an extraordinary largeness, and capable of receiving the whole garrison in order of battle. The cathedral dedicated to the Virgin Mary is one of the finest in Europe. The body of the church is very large, and there are rich chapels, the pillars of which are adorned with marble tombs that are of exquisite workmanship, and add greatly to the beauty of the place. There are two galleries, one of which is of copper, finely wrought. The door of the choir is of the same metal, and well carved. The steeple of this church is very high, and built in the form of a pyramid; and from its top you have a view of the city, which is one of the finest and most agreeable in the Low Countries. There are nine parishes, four abbeys, and several convents for both sexes. The citadel is very advantageously situated on high ground, and commands the whole city. Cambray is one of the most opulent and commercial cities in the Low Countries; and makes every year a great number of pieces of cambric, with which the inhabitants drive a great trade. E. Long 3. 20. N. Lat. 50. 11.



Cambray (M. de Fenelon, archbishop of). See Fenelon.

CAMBRESIS, a province of France in the Netherlands, about 25 miles in length. It is bounded on the north and east by Hainhalt, on the south by Picardy, and on the west by Artois. It is a very fertile and populous country; and the inhabitants are industrious, active, and ingenious. The trade consists principally in corn, sheep, very fine wool, and fine linen cloth. Cambray is the capital town.

CAMBRIA, a name for the principality of Wales.

CAMBRIC, in commerce, a species of linen made of flax, very fine and white; the name of which was originally derived from the city of Cambray, where they were first manufactured. They are now made at other places in France.

The manufacture of cambrics hath long since proved of extraordinary advantage to France. For many years it appeared that England did not in this article contribute less than 200,000l. per annum to the interest of France. This proved motive sufficient to induce the parliament of Great Britain to enact many salutary laws to prevent this great loss of wealth. See 18 Geo. II. c. 36. and 21 Geo. II. c. 26. See also stat. 32 Geo. II. c. 32 and 4 Geo. III. c. 37. which regulates the cambric manufactory, not long since introduced into Winchelsea in Sussex; but very soon abolished. The cambrics now allowed in Britain are manufactured in Scotland and Ireland. Any persons convicted of wearing, selling (except for exportation), or making up for hire any cambric or French lawns, are liable to a penalty of 5l. by the two first statutes cited above.

CAMBRIDGE, a town of England, and capital of the county of that name. It takes the name of Cambridge from the bridge over the Cam, which divides the town into two parts. Either it or a place in the neighbourhood was styled *Camboritum* in the time of the Romans. It suffered much during the wars with the Danes. Here was a castle built by William the Conqueror, of which the gatehouse yet remains, and is now the county goal. By Doomsday-book it appears, that it then had ten wards, containing 387 houses. In William Rufus's reign it was quite destroyed by Roger de Montgomery; but Henry I. bestowed many privileges upon it, particularly an exemption from the power of the sheriff, on condition of its

paying

Cambridge paying yearly into the exchequer 100 merks (equivalent to 1000 pounds now), and from tolls, lastage, pontage, passage, and stallage, in all fairs of his dominions.

The university enjoys great privileges. It is governed by the chancellor, who is always some nobleman, and may be changed every three years, and has a commissary under him; the high steward, chosen by the senate; the vice-chancellor chosen by the whole body of the university, out of two named by the heads of the colleges; two proctors chosen every year; two taxers, who, with the proctors, regulate the weights and measures. The other officers are, a register, or keeper of the archives, three esquire beadles, one yeoman beadle, and a library keeper. Each college has its schools and library, as at Oxford, of which those of Trinity and St John are the most considerable. King George I. purchased for 1000l. the library of Dr Moor bishop of Ely, consisting of 30,000 volumes, and made a present of it to the university; which, out of gratitude, erected, in 1739, a fine marble statue of that prince in the senate-hall of King's-college. A professor of modern languages and history was also established here and at Oxford, with a salary of 400l. for himself and two to teach under him, by king George I. in 1724. In 1728, a professorship for natural philosophy was erected by Dr Woodward, a professor at Gresham college, London, with a salary of 150l. a-year. The same gentleman left them also his collection of fossils, and a part of his library. The master and fellows of Catherine-hall are trustees of an hospital for the cure of poor diseased people gratis; for the building and furnishing of which, Dr Addenbroke left 4000l. Each college has its chapel for worship; but public sermons are preached at St Mary's church. The following are the most remarkable structures: 1. The chapel of king's-college, which for its contrivance and extent, fine carved work in wood and stone, and painted windows, is hardly to be equalled in the world. It is entirely of free stone, roof and all, without one pillar to support it. 2. Trinity-college and library, wonderful both for the design and execution. We must not omit to observe, that a fellowship was founded at Magdalen-college, called *the travelling Norfolk fellowship*, because it is appropriated to gentlemen of that country. E. Long. 0. 7. N. Lat. 52. 15.

CAMBRIDGESHIRE, a county of England, bounded on the east by Norfolk, on the south by Essex and Hertfordshire, on the west by Bedfordshire and Huntingdonshire, and on the north by Lincolnshire. It is about 40 miles long, 25 broad, and 130 in circumference. It lies in the diocese of Ely; and sends six members to parliament, two for the county, two for the university, and two for the town of Cambridge. The air is very different in different parts of the county. In the fens it is moist and foggy, and therefore not so wholesome; but in the south and east parts it is very good, these being much drier than the other: but both, by late improvements, having been rendered very fruitful, the former by draining, and the latter by cinquefoil: so that it produces plenty of corn, especially barley, saffron, and hemp, and affords the richest pastures. The rivers abound with fish, and the fens with wild fowl. The principal manufactures of the county are malt, paper, and baskets. The chief rivers are the Ouse, which divides the county into two parts, and is navigable from Cambridge to Lynn in Norfolk; the Cam, which in the British signifies *crooked*, to denote its winding; the Welland, the Glene, the Witham, and that called *Peterborough river*, which is navigable to that city from Wisbech. The fens called *Bedford level* consist of about 300,000 acres of marshy ground, lying in Cambridgeshire, Norfolk, Suffolk, Huntingdonshire, Northamptonshire, and Lincolnshire, and surrounded on all hands, except towards the sea, with high lands. As it appears to have been dry land formerly, the great change it has undergone must have been owing either to a violent breach and inundation of the sea, or to earthquakes. As the towns in and about the fens were great sufferers by the stagnation of the waters in summer, and want of provisions in winter, many attempts were made to drain them, but without success, until the time of Charles I. in which, and that of his son, the work was happily completed. In these fens are a great many DECOYS, in which incredible numbers of ducks, and other wild fowl, are caught during the season.

Cambridgeshire.

CAMBRIDGE, in New-England, a pleasant village, four miles from Boston, famous for its university, consisting of four elegant brick edifices, viz. Harvard Hall, Massachusetts Hall, Hollis Hall, and Holden chapel, handsomely inclosed. Harvard Hall is divided into six apartments; one of which is appropriated for the library, one for the museum, two for the philosophical apparatus, one is used for a chapel, and the other for a dining hall. The library in 1787, consisted of 12,000 volumes; and will be continually increasing from the interest of permanent funds, as well as from casual benefactions. The philosophical apparatus belonging to this university, cost between 1400 and 1500l. lawful money, and is the most elegant and complete of any in America.

*Morse's Geography.*

Agreeably to the present constitution of Massachusetts, his excellency the governor, the council and senate, the president of the university, and the ministers of the congregational churches in the towns of Boston, Charlestown, Cambridge, Watertown, Roxbury, and Dorchester, are *ex officiis*, overseers of the university.

The corporation is a distinct body, consisting of seven members, in whom is vested the property of the university.

The instructors in the university, are a president, Hollisian professor of divinity, Hollisian professor of the mathematics and natural philosophy, Hancock professor of oriental languages, professor of anatomy and surgery, professor of the theory and practice of physic, professor of chemistry and materia medica, and four tutors.

This university as to its library, philosophical apparatus and professorships, is at present the first literary institution on this continent. It has generally from 120 to 150 students.

CAMBRIDGE, in Maryland, a pleasant village on Choptank river, about ten miles from its entrance into Chesapeak Bay, a place of considerable trade. N. Lat. 38. 35. W. Lat. W. Long. 76. 20.

*CAMBRIDGE Manuscript*, a copy of the Gospels and Acts of the Apostles in Greek and Latin. Beza found it in the monastery of Irenæus at Lyons, in the year 1562, and gave it to the university of Cambridge in 1582. It is a quarto size, and written on vellum; sixty-six leaves of it are much torn and mutilated, ten

of

of which are supplied by a later transcriber. Beza conjectures, that this manuscript might have existed so early as the time of Irenæus: Wetstein apprehends, that it either returned or was first brought from Egypt into France; that it is the same copy which Druthmar, an ancient expositor, who lived about the year 840, had seen, and which, he observes, was ascribed to St Hilary; and that R. Stephens had given a particular account of it in his edition of the New Testament in 1550. It is usually called *Stephens's second manuscript*. Mill agrees with F. Simon in opinion, that it was written in the western part of the world by a Latin scribe, and that it is to a great degree interpolated and corrupted: he observes, that it agrees so much with the Latin Vulgate, as to afford reason for concluding, that it was corrected or formed upon a corrupt and faulty copy of that translation. From this and the Clermont copy of St Paul's Epistles, Beza published his larger Annotations in 1582.

CAMBYSES. See (*History of*) PERSIA.

CAMCHATKA. See KAMTCHATKA.

CAMDEN (William), the great antiquarian, was born in London in the year 1551. His father was a native of Litchfield in Staffordshire, who settling in London, became a member of the company of painter-stainers, and lived in the Old Bailey. His mother was of the ancient family of Curwen, of Wirkington, in Cumberland. He was educated first at Christ's hospital, and afterwards at St Paul's school; from thence he was sent in 1566 to Oxford, and entered servitor of Magdalen college; but being disappointed of a demy's place, he removed to Broad-gate hall, and somewhat more than two year's after, to Christ-church, where he was supported by his kind friend and patron Dr Thornton. About this time he was a candidate for a fellowship of All-Souls college, but lost it by the intrigues of the Popish party. In 1570, he supplicated the regents of the university to be admitted bachelor of arts; but in this also he miscarried. The following year Mr Camden came to London, where he prosecuted his favourite study of antiquity, under the patronage of Dr Goodman, dean of Westminster, by whose interest he was made second master of Westminster school in 1575. From the time of his leaving the university to this period, he took several journeys to different parts of England, with a view to make observations and collect materials for his *Britannia*, in which he was now deeply engaged. In 1581 he became intimately acquainted with the learned president Brisson, who was then in England; and in 1586 he published the first edition of his Britannia. In 1593 he succeeded to the head mastership of Westminster school on the resignation of Dr Grant. In 1597 he published his Greek grammar, and the same year was made Clarenceux king at arms. In the year 1660 Mr Camden made a tour to the north, as far as Carlisle, accompanied by his friend Mr (afterwards Sir Robert) Cotton. In 1606 he began his correspondence with the celebrated president de Thou, which continued to the death of that faithful historian. In the following year he published his last edition of the Britannia, which is that from which the several English translations have been made; and in 1608 he began to digest his materials for a history of the reign of queen Elizabeth. In 1609, after recovering from a dangerous illness, he retired to Chislehurst in Kent, where he continued to spend the summer-months during the remainder of his life. The first part of his annals of the queen did not appear till the year 1615, and he determined that the second volume should not appear till after his death (A). The work was entirely finished in 1617; and from that time he was principally employed in collecting more materials for the further improvement of his Britannia. In 1622, being now upwards of 70, and finding his health decline apace, he determined to lose no time in executing his design of founding a history-lecture in the university of Oxford. His deed of gift was accordingly transmitted by his friend Mr Heather, to Mr Gregory Wheare, who was, by himself, appointed his first professor. He died at Chislehurst, in 1623, in the 73d year of his age; and was buried with great solemnity in Westminster-abbey in the south aisle, where a monument of white marble was erected to his memory. Camden was a man of singular modesty and integrity; profoundly learned in the history and antiquities of Britain, and a judicious and conscientious historian. He was reverenced and esteemed by the literati of all nations, and will be ever remembered as an honour to the age and country wherein he lived. Besides the works already mentioned, he was author of an excellent Greek grammar, and of several tracts in Hearne's collection.

CAMEL, in zoology. See CAMELUS.

CAMEL, in mechanics, a kind of machine used in Holland for raising or lifting ships, in order to bring them over the Pampus, which is at the mouth of the river Y, where the shallowness of the water hinders large ships from passing. It is also used in other places, particularly at the dock of Petersburg, the vessels built here being in their passage to Cronstadt lifted over the bar by means of camels. These machines were originally invented by the celebrated De Wit, for the purpose abovementioned; and were introduced into Russia by Peter the Great, who obtained the model of them when he worked in Holland as a common shipwright. A camel is composed of two separate parts, whose outsides are perpendicular, and whose insides are concave, shaped so as to embrace the hull of a ship on both sides. Each part has a small cabin with sixteen pumps and ten plugs, and contain twenty men. They are braced to a ship underneath by means of cables, and entirely enclose its sides and bottom; being then towed to the bar,

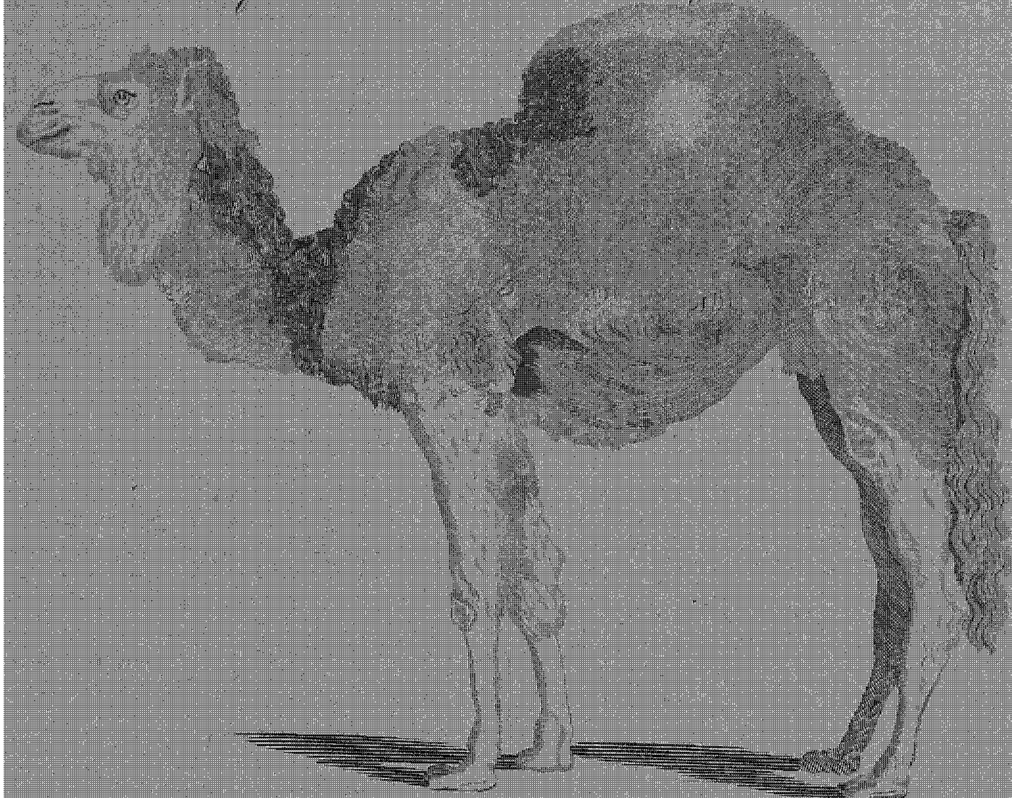


(A) The reign of queen Elizabeth was so recent when the first volume of the annals was published, that many of the persons concerned, or their dependents, were still living. It is no wonder, therefore, that the honest historian should offend those whose actions would not bear inquiry. Some of his enemies were clamorous and troublesome; which determined him not to publish the second volume during his life, but that posterity might be in no danger of disappointment, he deposited one copy in the Cotton library, and transmitted another to his friend Dupuy at Paris. It was first printed at Leyden in 1625.

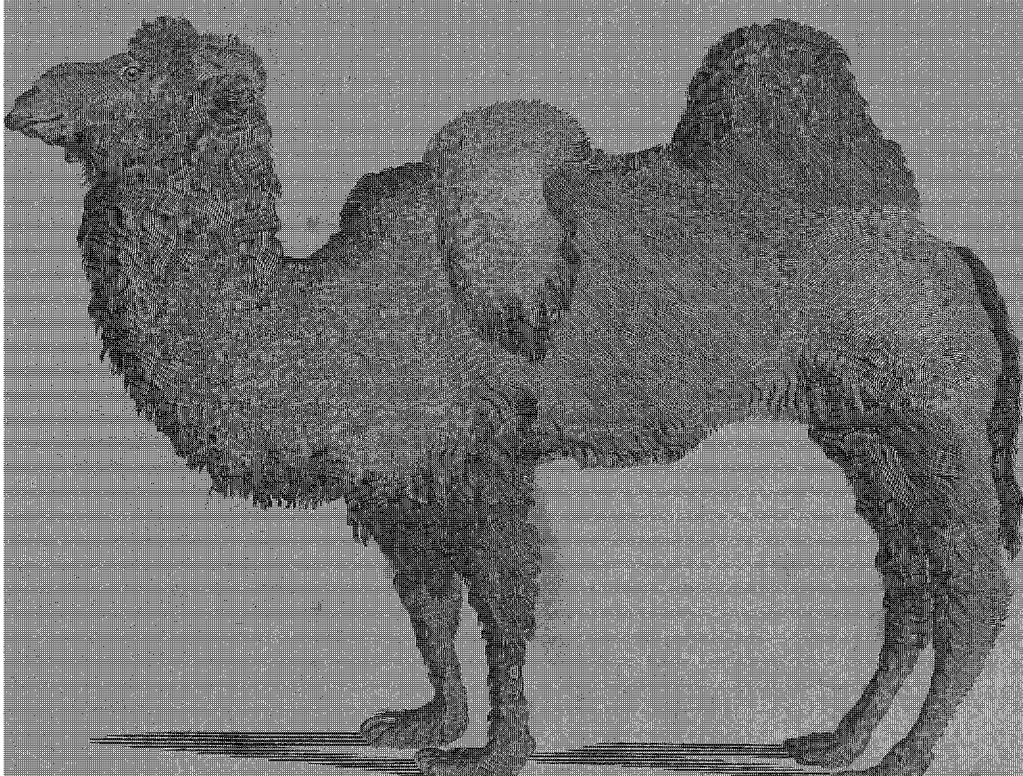
CAMELUS

Plate CXIII

African Camel or Dromedary



Bactrian Camel



R. Scot Sculp. Philad.

Camelford | Camelus.

bar, the plugs are opened, and the water admitted until the camel sinks with the ship and runs a-ground. Then, the water being pumped out, the camel rises, lifts up the vessel, and the whole is towed over the bar. This machine can raise the ship eleven feet, or, in other words, make it draw eleven feet less water.

CAMELFORD, a borough town of Cornwall in England, consisting of about 100 houses, badly built; but the streets are broad and well paved. W. Long. 5. 4. N. Lat. 50. 40. It sends two members to parliament; and gives title of baron to Thomas Pitt, elder brother of the great earl of Chatham.

CAMELLIA, in botany: A genus of the polyandria order, belonging to the monodelphia class of plants; and in the natural method ranking under the 37th order, *Columniferæ*. The calyx is imbricated and polyphyllous, with the interior leaves larger than the exterior ones. Of this genus there is but one species, a native both of China and Japan. Thunberg, in his *Flora Japonica*, describes its growing every where in the groves and gardens of Japan, where it becomes a prodigiously large and tall tree, highly esteemed by the natives for the elegance of its large and very variable blossoms, and its evergreen leaves; it is there found with single and double flowers, which also are white, red, and purple, and produced from April to October. Representations of this flower are frequently met with in Chinese paintings. In Britain, the *Camellia* is generally treated as a stove plant, and propagated by layers; it is sometimes placed in the greenhouse; but it appears to be one of the properest plants imaginable for the conservatory. At some future time it may, perhaps, not be uncommon to treat it as a *Laurustinus* or *Magnolia:* the high price at which it has hitherto been sold, may have prevented its being hazarded in this way. The blossoms are of a firm texture, but apt to fall off long before they have lost their brilliancy; it therefore is a practice with some to stick such deciduous blossoms on some fresh bud, where they continue to look well for a considerable time. Petiver considered this plant as a species of tea-tree; and future observations will probably confirm his conjecture.

CAMELODUM. See CAMALODUNUM.

CAMELOPARDALIS, in zoology, the trivial name of a species of CERVUS.

CAMELUS, or CAMEL, in zoology, a genus of quadrupeds belonging to the order of pecora. The characters of the camel are these: It has no horns; it has six fore-teeth in the under jaw; the laniarii are wide set, three in the upper, and two in the lower jaw; and there is a fissure in the upper lip, resembling a cleft in the lip of a hare. The species are:

1. The dromedarius, or Arabian camel, with one bunch of protuberance on the back. It has four callous protuberances on the fore-legs, and two on the hind ones. This species is common in Africa, and the warmer parts of Asia; not that it is spread over either of the continents. It is a common beast of burden in Egypt, and along the countries which border on the Mediterranean Sea; in the kingdom of Morocco, Sara or the Desert, and in Ethiopia: but no where south of those kingdoms. In Asia, it is equally common in Turkey and Arabia; but is scarcely seen farther north than Persia, being too tender to bear a more severe climate. India is destitute of this animal.

2. The Bactrianus, or Bactrian camel, has two bunches on the back, but is in all other respects like the preceding; of which it seems to be a mere variety, rather than a different species; and is equally adapted for riding or carrying loads. It is still found wild in the deserts of the temperate parts of Asia, particularly in those between China and India. These are larger and more generous than the domesticated race. The Bactrian camel, which is very common in Asia, is extremely hardy, and in great use among the Tartars and Mongols, as a beast of burden, from the Caspian Sea to the empire of China. It bears even so severe a climate as that of Siberia, being found about the lake Baikal, where the Burats and Mongols keep great numbers. They are far less than those which inhabit Western Tartary. Here they live during winter on willows and other trees, and are by this diet reduced very lean. They lose their hair in April, and go naked all May, amidst the forests of that severe climate. To thrive, they must have dry ground and salt marshes. There are several varieties among the camels. The Turkman is the largest and strongest. The Arabian is hardy. What is called the Dromedary, Maihary, and Raguahl, is very swift. The common sort travel about 30 miles a day. The last, which has a less bunch, and more delicate shape, and also as much inferior in size, never carries burdens; but is used to ride on. In Arabia, they are trained for running-matches: and in many places for carrying couriers, who can go above 100 miles a day on them; and that for nine days together, over burning deserts, unhabitable by any living creature. The African camels are the most hardy, having more distant and more dreadful deserts to pass over than any of the others, from Numidia to the kingdom of Ethiopia. In Western Tartary there is a white variety, very scarce, and sacred to the idols and priests. The Chinese have a swift variety, which they call by the expressive name of Fong Kyo Fo, or camels with feet of the wind. Fat of camels, or, as those people call it, oil of bunches, being drawn from them, is esteemed in many disorders, such as ulcers, numbness, and consumptions. This species of camel is rare in Arabia, being an exotic, and only kept by the great men.

Camels have constituted the riches of Arabia from the time of Job to the present day. The patriarch reckoned 600 camels among his pastoral treasures, and the modern Arabs estimate their wealth by the numbers of these useful animals. Without them great part of Africa would be wretched; by them the whole commerce is carried through arid and burning tracts, impassable but by beasts which Providence formed expressly for the scorched deserts. Their soles are adapted to the sands they are to pass over, their toughness and spungy softness preventing them from cracking. Their great powers of sustaining abstinence from drinking, enables them to pass over unwatered tracts for many days, without requiring the least liquid; and their patience under hunger is such, that they will travel many days fed only with a few dates, or some small balls of bean or barley-meal, or on the miserable thorny plants they meet with in the deserts.

The Arabians regard the camel as a present from heaven, a sacred animal, without whose assistance they could neither subsist, carry on trade, nor travel. Camel's

Camelus. mel's milk is their common food. They alſo eat its fleſh, that of the young camel being reckoned highly ſavoury. Of the hair of thoſe animals, which is fine and ſoft, and which is completely renewed every year, the Arabians make ſtuffs for clothes, and other furniture. With their camels, they not only want nothing, but have nothing to fear. In one day they can perform a journey of fifty leagues into the deſert, which cuts off every approach from their enemies. All the armies of the world would periſh in purſuit of a troop of Arabs. Hence they never ſubmit, unleſs from choice, to any power. With a view to his predatory expeditions, the Arab inſtructs, rears, and exerciſes his camels. A few days after their birth, he folds their limbs under their belly, forces them to remain on the ground, and, in this ſituation, loads them with a pretty heavy weight, which is never removed but for the purpoſe of replacing a greater. Inſtead of allowing them to feed at pleaſure, and to drink when they are dry, he begins with regulating their meals, and makes them gradually travel long journeys, diminiſhing, at the ſame time, the quantity of their aliment. When they acquire ſome ſtrength, they are trained to the courſe. He excites their emulation by the example of horſes, and, in time, renders them more robuſt. In fine, after he is certain of the ſtrength, fleetneſs, and ſobriety of his camels, he loads them both with his own and their food, ſets off with them, arrives unperceived at the confines of the deſert, robs the firſt paſſengers he meets, pillages the ſolitary houſes, loads his camels with the booty, and, if purſued, he is obliged to accelerate his retreat. It is on theſe occaſions that he unfolds his own talents and thoſe of the camels. He mounts one of the fleeteſt, conducts the troop, and makes them travel night and day, without, almoſt, either ſtopping, eating, or drinking; and, in this manner, he eaſily performs a journey of three hundred leagues in eight days. During this period of motion and fatigue, his camels are perpetually loaded, and he allows them each day, one hour only of repoſe, and a ball of paſte. They often run in this manner nine or ten days, without finding water; and when, by chance, there is a pool at ſome diſtance, they ſcent the water half a league off. Thirſt makes them double their pace, and they drink as much at once as ſerves them for the time that is paſt, and as much to come; for their journeys often laſt ſeveral weeks, and their abſtinence continues an equal time.

Of all carriages, that by camels is the cheapeſt and moſt expeditious. The merchants and other paſſengers unite in a caravan, to prevent the inſults and robberies of the Arabs. Theſe caravans are often very numerous, and are always compoſed of more camels than men. Each camel is loaded in proportion to his ſtrength; and, when overloaded, he refuſes to march, and continues lying till his burden is lightened. The large camels generally carry a thouſand, or even twelve hundred pounds weight, and the ſmalleſt from ſix to ſeven hundred. In theſe commercial travels, their march is not haſtened: As the route is often ſeven or eight hundred leagues, their motions and journeys are regulated. They walk only, and perform about from ten to twelve leagues each day. Every night they are unloaded, and allowed to paſture at freedom. When in a rich country, or fertile meadow, they eat, in leſs than an hour, as much as ſerves them to ruminate the whole night, and to nouriſh them during twenty-four hours. But they ſeldom meet with ſuch paſtures; neither is this delicate food neceſſary for them. They even ſeem to prefer wormwood, thiſtles, nettles, broom, caſſia, and other prickly vegetables, to the ſofteſt herbage. As long as they find plants to brouſe, they eaſily diſpenſe with drink. This facility of abſtaining long from drink proceeds not, however, from habit alone, but is rather an effect of their ſtructure. Independent of the four ſtomachs, which are common to ruminating animals, the camels have a fifth bag, which ſerves them as a reſervoir for water. This fifth ſtomach is peculiar to the camel. It is ſo large as to contain a vaſt quantity of water, where it remains without corrupting, or mixing with the other aliments. When the animal is preſſed with thirſt, and has occaſion for water to macerate his dry food in ruminating, he makes part of this water mount into his paunch, or even as high as the œſophagus, by a ſimple contraction of certain muſcles. It is by this ſingular conſtruction that the camel is enabled to paſs ſeveral days without drinking, and to take at a time a prodigious quantity of water, which remains in the reſervoir pure and limpid, becauſe neither the liquors of the body, nor the juices of digeſtion, can mix with it. Travellers, when much oppreſſed with drought, are ſometimes obliged to kill their camels in order to have a ſupply of drink from theſe reſervoirs. Theſe inoffenſive creatures muſt ſuffer much; for they utter the moſt lamentable cries, eſpecially when overloaded. But, though perpetually oppreſſed, their fortitude is equal to their docility. At the firſt ſignal, they bend their knees and lie down to be loaded, which ſaves their conductor the trouble of raiſing the goods to a great height. As ſoon as they are loaded, they riſe ſpontaneouſly, and without any aſſiſtance. One of them is mounted by their conductor, who goes before, and regulates the march of all the followers. They require neither whip nor ſpur. But, when they begin to be tried, their courage is ſupported, or rather their fatigue is charmed, by ſinging, or by the ſound of ſome inſtrument. Their conductors relieve each other in ſinging; and, when they want to prolong the journey, they give the animals but one hour's reſt; after which, reſuming their ſong, they proceed on their march for ſeveral hours more, and the ſinging is continued till they arrive at another reſting place, when the camels again lie down; and their loads, by unlooſing the ropes, are allowed to glide off on each ſide of the animals. Thus they ſleep on their bellies in the middle of their baggage, which, next morning is fixed on their backs with equal quickneſs and facility as it had been detached the evening before.

Fatigue, hunger, thirſt, and meagreneſs, are not the only inconveniences to which theſe animals are ſubjected: To all theſe evils they are prepared by caſtration. One male is only left for eight or ten females; and the labouring camels are generally geldings. They are unqueſtionably weaker than unmutilated males; but they are more tractable, and at all ſeaſons ready for ſervice. While the former are not only unmanageable, but almoſt furious, during the rutting ſeaſon, which laſts forty days, and returns annually in the ſpring. It is then ſaid, that they foam

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Camelus continually, and that one or two red veſicles, as large as a hog's bladder, iſſue from their mouths. In this ſeaſon they eat little, attack and bite animals, and even their own maſters, to whom at all other times they are very ſubmiſſive. Their mode of copulating differs from that of all other quadrupeds; for the female, inſtead of ſtanding, lies down on her knees, and receives the male in the ſame poſition that ſhe repoſes, or is loaded. This poſture, to which the animals are early accuſtomed, becomes natural, ſince they aſſume it ſpontaneouſly in coition. The time of geſtation is near twelve months, and, like all large quadrupeds, the females bring forth only one at a birth. Her milk is copious and thick; and, when mixed with a large quantity of water, affords an excellent nouriſhment to men. The females are not obliged to labour, but are allowed to paſture and produce at full liberty. The advantage derived from their produce and their milk is perhaps ſuperior to what could be drawn from their working. In ſome places, however, moſt of the females are caſtrated, in order to fit them for labour; and it is alleged, that this operation, inſtead of diminiſhing, augments their ſtrength, vigour, and plumpneſs. In general, the fatter camels are, they are the more capable of enduring great fatigue. Their bunches ſeem to proceed from a redundance of nouriſhment; for, during long journeys, in which their conductor is obliged to huſband their food, and where they often ſuffer much hunger and thirſt, theſe bunches gradually diminiſh, and become ſo flat, that the place where they were is only perceptible by the length of the hair, which is always longer on theſe parts than on the reſt of the back. The meagreneſs of the body augments in proportion as the bunches decreaſe. The Moors, who tranſport all articles of merchandiſe from Barbary and Numidia, as far as Æthiopia, ſet out with their camels well laden, which are very fat and vigorous; and bring back the ſmall animals ſo meagre, that they commonly ſell at a low price to the Arabs of the Deſert, to be again fattened.

We are told by the ancients, that camels are in a condition for propagating at the age of three years. This aſſertion is ſuſpicious; for, in three years, they have not acquired one half of their growth. The penis of the male, like that of the bull, is very long, and very ſlender. During erection, it ſtretches forward, like that of all other quadrupeds; but, in its ordinary ſtate, the ſheath is drawn backward, and the urine is diſcharged from between the hind legs; ſo that both males and females urine in the ſame manner. The young camel ſucks his mother twelve months; but, when meant to be trained, in order to render him ſtrong and robuſt in the chace, he is allowed to ſuck and paſture at freedom during the firſt years, and is not loaded, or made to perform any labour, till he is four years old. He generally lives forty and ſometimes fifty years, which duration of life is proportioned to the time of his growth. There is no foundation for what has been advanced by ſome authors, that he lives one hundred years.

By conſidering, under one point of view, all the qualities of this animal, and all the advantages derived from him, it muſt be acknowledged that he is the moſt uſeful creature ſubjected to the ſervice of man. Gold and ſilk conſtitute not the true riches of the Eaſt. The camel is the genuine treaſure of Aſia. He is more valuable than the elephant; for he may be ſaid to perform an equal quantity of labour at a twentieth part of the expence. Beſides, the whole ſpecies are under ſubjection to man, who propagates and multiplies them at pleaſure. But he has no ſuch dominion over the elephants, whom he cannot multiply, and the individuals of whom he conquers with great labour and difficulty. The camel is not only more valuable than the elephant, but is perhaps equal in utility to the horſe, the aſs, and the ox, when their powers are united. He carries as much as two mules; though he eats as little, and feeds upon herbs equally coarſe as the aſs. The female furniſhes milk longer than the cow. The fleſh of a young camel is as good and wholeſome as veal: The Africans and Arabs fill their pots and tubs with it, which is fried with greaſe, and preſerved in this manner during the whole year for their ordinary repaſts: The hair is finer and more in requeſt than the beſt wool. Even their excrements are uſeful: for ſal ammoniac is made of their urine; and their dung, dried in the ſun and pulveriſed, ſerves for litter to themſelves, as well as to horſes, with which people frequently travel in countries where no hay or ſtraw can be had. In fine, their dung makes excellent fuel, which burns freely, and gives as clear and nearly as hot a flame as dry wood, which is of great uſe in the deſerts, where not a tree is to be found, and where, for want of combuſtible materials, fire is as ſcarce as water. Camelus.

3. The Glama, Llama, or South-American camel-ſheep, has an almoſt even back, ſmall head, fine black eyes, and very long neck, bending much, and very protuberant near the junction with the body: in a tame ſtate, with ſmooth ſhort hair; in a wild ſtate, with long coarſe hair, white, grey, and ruſſet, diſpoſed in ſpots; with a black line from the head along the top of the back to the tail, and belly white. The ſpotted may poſſibly be the tame, the laſt the wild, llamas. The tail is ſhort; the height from four to four feet and a half; the length from the neck to the tail, ſix feet. The carcaſe diveſted of ſkin and offals, according to the editor of Mr Byron's voyage, weighed 200lb. In general, the ſhape exactly reſembles a camel, only it wants the dorſal bunch. It is the camel of Peru and Chili; and, before the arrival of the Spaniards, was the only beaſt of burden known to the Indians. It is very mild, gentle, and tractable. Before the introduction of mules, they were uſed by the Indians to plough the land: at preſent they ſerve to carry burdens of about 100lb. They go with great gravity; and, like their Spaniſh maſters, nothing can prevail upon them to change their pace. They lie down to the burden; and when wearied, no blows can provoke them to go on. Feuillee ſays, they are ſo capricious, that if ſtruck, they inſtantly ſquat down, and nothing but careſſes can make them ariſe. When angry, they have no other method of revenging their injuries than by ſpitting; and they can ejaculate their ſaliva to the diſtance of ten paces: if it falls on the ſkin, it raiſes an itching and a reddiſh ſpot. Their fleſh is eaten, and is ſaid to be as good as mutton. The wool has a ſtrong diſagreeable ſcent. They are very ſure-footed; therefore uſed to carry the Peruvian ores over the ruggedeſt hills and narroweſt paths of the Andes. They

inhabit that vaſt chain of mountains their whole length to the ſtraits of Magellan; but except where theſe hills approach the ſea, as in Patagonia, never appear on the coaſts. Like the camel, they have powers of abſtaining long from drink, ſometimes for four or five days: like that animal, their food is coarſe and trifling.—In a wild ſtate, they keep in great herds in the higheſt and ſteepeſt parts of the hills; and while they are feeding, one keeps centry on the pinnacle of ſome rock: if it perceives the approach of any one, it neighs; the herd takes the alarm, and goes off with incredible ſpeed. They outrun all dogs, ſo there is no other way of killing them but with the gun. They are killed for the ſake of their fleſh and hair; for the Indians weave the laſt into cloth. From the form of the parts of generation in both ſexes, no animal copulates with ſuch difficulty. It is often the labour of a day, *antequam actum ipſum venereum incipiant, et abſolvant.*

4. The Pacos, or ſheep of Chili, has no bunch on the back. It is covered with a fine valuable wool, which is of a roſe red colour on the back of the animal, and white on the belly. They are of the ſame nature with the preceding; inhabit the ſame places, but are more capable of ſupporting the rigour of froſt and ſnow: they live in vaſt herds; are very timid, and exceſſively ſwift. The Indians take the pacos in a ſtrange manner: they tie cords with bits of cloth or wool hanging to them, above three or four feet from the ground, croſs the narrow paſſes of the mountains, then drive thoſe animals towards them, which are ſo terrified by the flutter of the rags, as not to dare to paſs, but, huddling together, give the hunters an opportunity to kill with their ſlings as many as they pleaſe. The tame ones will carry from 50 to 75lb.; but are kept principally for the ſake of the wool and the fleſh, which is exceedingly well taſted.

CAMERA Æolia, a contrivance for blowing the fire, for the fuſion of ores, without bellows; by means of water falling through a funnel into a cloſe veſſel, which ſends from it ſo much air or vapour as continually blows the fire: if there be the ſpace of another veſſel for it to expatiate in by the way, it there lets fall its humidity, which otherwiſe might hinder the work. This contrivance was named *camera Æolia* by Kircher.

*Camera Lucida*, a contrivance of Dr Hook for making the image of any thing appear on a wall in a light room, either by day or night. Oppoſite to the place or wall where the appearance is to be, make a hole of at leaſt a foot in diameter, or if there be a high window with a caſement of this dimenſion in it, this will do much better without ſuch hole or caſement opened. At a convenient diſtance, to prevent its being perceived by the company in the room, place the object or picture intended to be repreſented, but in an inverted ſituation. If the picture be tranſparent, reflect the ſun's rays by means of a looking-glaſs, ſo as that they may paſs through it towards the place of repreſentation; and to prevent any rays from paſſing aſide it, let the picture be encompaſſed with ſome board or cloth. If the object be a ſtatue, or a living creature, it muſt be much enlightened by caſting the ſun's rays on it, either by reflection, refraction, or both. Between this object and the place of repreſentation put a broad convex glaſs, ground to ſuch a convexity as that it may repreſent the object diſtinctly in ſuch place. The nearer this is ſituated to the object, the more will the image be magnified on the wall, and the further the leſs; ſuch diverſity depending on the difference of the ſphere of the glaſſes. If the object cannot be conveniently inverted, there muſt be two large glaſſes of proper ſpheres, ſituated at ſuitable diſtances, eaſily found by trial, to make the repreſentations erect. This whole apparatus of object, glaſſes, &c. with the perſons employed in the management of them, are to be placed without the window or hole, ſo that they may not be perceived by the ſpectators in the room, and the operation itſelf will be eaſily performed. Phil. Tranſ. Nº 38. p. 741, ſeq.



*Camera Obſcura*, or *Dark Chamber*, in *Optics*, a machine, or apparatus, repreſenting an artificial eye; whereon the images of external objects, received thro' a double convex glaſs, are exhibited diſtinctly, and in their native colours, on a white matter placed within the machine, in the focus of the glaſs.

The firſt invention of this inſtrument is aſcribed to Baptiſta Porta. See his *Magia Naturalis*, lib. xvii. cap. 6. firſt publiſhed at Francfort about the year 1589 or 1591; the firſt four books of this work were publiſhed at Antwerp in 1560.

The *camera obſcura* affords very diverting ſpectacles; both by exhibiting images perfectly like their objects, and each clothed in their native colours; and by expreſſing, at the ſame time, all their motions; which latter no other art can imitate. By means of this inſtrument, a perſon unacquainted with deſigning will be able to delineate objects with the greateſt accuracy and juſtneſs, and another well verſed in painting will find many things herein to perfect his art. See the conſtruction under Dioptrics.

CAMERARIA, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 30th order, *Contortæ*. There are two horizontal follicles at the baſe of the ſeed-caſe. The ſeeds are inſerted into a proper membrane. Of this there are two ſpecies; the latifolia, and the anguſtifolia. The firſt is a native of the iſland of Cuba, and riſes with a ſhrubby ſtalk to the height of 10 or 12 feet, dividing into ſeveral branches, garniſhed with roundiſh pointed leaves placed oppoſite. The flowers are produced at the end of the branches in looſe cluſters, which have long tubes enlarging gradually upward, and at the top are cut into five ſegments, broad at their baſe, but ending in ſharp points; the flower is of a yellowiſh white colour. The ſecond ſort has an irregular ſhrubby ſtalk, which riſes about eight feet high, ſending out many branches which are garniſhed with very narrow thin leaves placed oppoſite at each joint. The flowers are produced ſcatteringly at the end of the branches, which are ſhaped like thoſe of the former ſort, but ſmaller. It is a native of Jamaica. Both theſe plants abound with an acrid milky juice like the ſpurge. They are propagated by ſeeds, which muſt be procured from the places of their growth. They may alſo be propagated by cuttings planted in a hot-bed during the ſummer-months: they muſt have a bark-ſtove, for they are very tender plants; but in warm weather they muſt have plenty of air.

CAMERARIUS (Joachim), one of the moſt learned ed writers of his time, was born in 1500, at Bamberg, a city of Franconia; and obtained great reputation by his writings. He translated into Latin Herodotus, Demosthenes, Xenophon, Euclid, Homer, Theocritus, Sophocles, Lucian, Theodoret Nicephorus, &c. He published a catalogue of the bishops of the principal sees; Greek epistles; Accounts of his journeys, in Latin verse; a Commentary on Plautus; the Lives of Helius Eobanus, Hessus, and Philip Melancthon, &c. He died in 1574.

CAMERARIUS (Joachin), son of the former, and a learned physician, was born at Nuremberg in 1534. After having finished his studies in Germany, he went into Italy, where he obtained the esteem of the learned. At his return he was courted by several princes to live with them; but he was too much devoted to books, and the study of chemistry and botany, to comply. He wrote an hourtus medicus, and several other works. He died in 1598.

CAMERATED, among builders the same with vaulted or arched.

CAMERET-BAY, in the province of Brittany in France, forms the harbour of Brest. See BREST.

CAMERINO, a town of the ecclesiastical state in Italy, situated in E. Long. 13. 7. N. Lat. 45. 5.

CAMERLINGO, according to Ducange, signified formerly the pope's or emperor's treasure: at present, camerlingo is no where used but at Rome, where it denotes the cardinal who governs the ecclesiastical state and administers justice. It is the most eminent office at the court of Rome, because he is at the head of the treasury. During a vacation of the papal chair, the cardinal camerlingo publishes edicts, coins money, and exerts every other prerogative of a sovereign prince; he has under him a treasurer-general, auditor-general, and 12 prelates called *clerks of the chamber*.

CAMERON (John), one of the most famous divines among the Protestants of France in the 17th century, was born at Glasgow in Scotland, where he taught the Greek tongue; and having read lectures upon that language for about a year, travelled, and became professor at several universities, and minister at Bourdeaux. He published, 1. Theological lectures; 2. *Icon Johannis Cameronis*; and some miscellaneous pieces. He died in 1625, aged 60.

CAMERONIANS, a sect or party in Scotland, who separated from the Presbyterians in 1666, and continued to hold their religious assemblies in the fields.

The Cameronians took their denomination from Richard Cameron, a famous field-preacher, who, refusing to accept the indulgence to tender consciences, granted by king Charles II. as such an acceptance seemed an acknowledgment of the king's supremacy, and that he had before a right to silence them, made a defection from his brethren, and even headed a rebellion in which he was killed. His followers were never entirely reduced till the Revolution, when they voluntarily submitted to king William.

The Cameronians adhered rigidly to the form of government established in 1648.

CAMERONIANS, or *Cameronites*, is also the donomination of a party of Calvinists in France, who asserted that the will of man is only determined by the practical judgment of the mind; that the cause of mens doing good or evil proceeds from the knowledge which God infuses into them; and that God does not move the will physically, but only morally, in virtue of its dependence on the judgment of the mind. They had this name from John Cameron, a famous professor, first at Glasgow, where he was born, in 1580, and afterwards at Bordeaux, Sedan and Saumur; at which last place he broached his new doctrine of grace and free-will, which was formed by Amyrant, Cappel, Bochart, Daille, and others of the more learned among the reformed ministers, who judged Calvin's doctrines on these points too harsh. The Cameronians are a sort of mitigated Calvinists, and approach to the opinion of the Armenians. They are also called *Universalists*, as holding the universality of Christ's death; and sometimes *Amyraldists*. The rigid adherents to the synod of Dort accused them of Pelagianism, and even of Manicheism. The controversy between the parties was carried on with a zeal and subtilty scarce conceivable; yet all the question between them was only, Whether the will of man is determined by the immediate action of God upon it, or by the intervention of a knowledge which God impresses into the mind? The synod of Dort had defined that God not only illuminates the understanding, but gives motion to the will by making an internal change therein. Cameron only admitted the illumination, whereby the mind is morally moved, and explained the sentiment of the synod of Dort so as to make the two opinions consistent.



CAMES, a name given to the small slender rods of cast-lead, of which the glaziers make their turned lead.

Their lead being cast into slender rods of twelve or fourteen inches long each, is called the *came*; sometimes also they call each of these rods a *came*, which being afterwards drawn through their vice, makes their turned lead.

CAMILLUS (Marcus Furius), was the first who rendered the family of *Furius* illustrious. He triumphed four times, was five times dictator, and was honoured with the title of the *second founder of Rome*. In a word, he acquired all the glory a man can gain in his own country. Lucius Apuleius, one of the tribunes, prosecuted him to make him give an account of the spoils taken at Veii. Camillus anticipated judgment, and banished himself voluntarily. During his banishment, instead of rejoicing at the devastation of Rome by the Gauls, he exerted all his wisdom and bravery to drive away the enemy; and yet kept with the utmost strictness the sacred law of Rome, in refusing to accept the command which several private persons offered him. The Romans, who were besieged in the capitol, created him dictator in the year 363; in which office he acted with so much bravery and conduct, that he entirely drove the army of the Gauls out of the territories of the commonwealth. He died in the 81st year of his age, 365 years before the Christian æra

CAMILLI and CAMILLÆ, in antiquity, boys and girls of ingenuous birth, who ministered in the sacrifices of the gods; and especially those who attended the *flamen dialis*, or priest of Jupiter. The word seems borrowed from the language of the ancient Hetrurians, where

where it signified minister, and was changed from *casmillus*. The Tuscans also give the appellation *Camillus* to Mercury in quality of minister of the gods.

CAMINHA, a maritime town of Portugal, in the province of Entre-Duero-e-Minho, with the title of a duchy. It is situated at the mouth of the river Minho, in W. Long. 9. 15. N. Lat. 41. 44.

CAMIS or KAMIS, in the *Japanese Theology*, denote deified souls of ancient heroes, who are supposed still to interest themselves in the welfare of the people over whom they anciently commanded.

The camis answer to the heroes in the ancient Greek and Roman theology, and are venerated like the saints in the modern Romish church.

Besides the heroes or camis beatified by the consent of antiquity, the *mikaddos*, or pontiffs have deified many others, and continue still to grant the apotheosis to new worthies; so that they swarm with *camis*: the principal one is *Tensio Dai Sin*, the common father of Japan, to whom are paid devotions and pilgrimages extraordinary.

CAMISADE, in the art of war, an attack by surprise in the night, or at the break of day, when the enemy is supposed to be a-bed. The word is said to have taken its rise from an attack of this kind: wherein, as a badge or signal to know one another by, they bore a shift, in French called *chemise*, or *camise*, over their arms.

CAMISARDS, a name given by the French to the Calvinists of the Cevennes, who formed a league, and took up arms in their own defence, in 1688.

CAMLETINE, a slight stuff, made of hair and coarse silk, in the manner of camblet. It is now out of fashion.

CAMMA, and GOBBI, two provinces of the kingdom of Loango in Africa. The inhabitants are continually at war with each other. The weapons they formerly used in their wars were the short pike, bows and arrows, sword and dagger; but since the Europeans have become acquainted with that coast, they have supplied them with fire-arms. The chief town of Gobbi lies about a day's journey from the sea. Their rivers abound with a variety of fish; but are infested with sea-horses, which do great mischief both by land and water. The principal commerce with the natives is in logwood, elephants teeth, and tails, the hair of which is highly valued, and used for several curious purposes.

CAMMIN, a maritime town of Germany, in Brandenburg Pomerania, situated in E. Long. 15° N. Lat. 54°.

CAMOENS (Louis de), a famous Portuguese poet, the honour of whose birth is claimed by different cities. But according to N. Antonio, and Manuel Correa, his intimate friend, this event happened at Lisbon in 1517. His family was of considerable note, and originally Spanish. In 1370, Vasco Perez de Caamans, disgusted at the court of Castile, fled to that of Lisbon, where king Ferdinand immediately admitted him into his council, and gave him the lordships of Sardoal, Punnete, Marano, Amendo, and other considerable lands; a certain proof of the eminence of his rank and abilities. In the war of the succession, which broke out on the death of Ferdinand, Camoens sided with the king of Castile, and was killed in the battle of Aljabarota. But though John I. the victor, seized a great part of his estate, his widow, the daughter of Gonsalo, Tereyro, grand master of the order of Christ, and general of the Portuguese army, was not reduced beneath her rank. She had three sons who took the name of *Camoens*. The family of the eldest intermarried with the first nobility of Portugal; and even, according to Castera, with the blood royal. But the family of the second brother, whose fortune was slender, had the superior honour to produce the author of the Lusiad.



Early in his life the misfortunes of the poet began. In his infancy, Simon Vaz de Camoens, his father, commander of a vessel, was shipwrecked at Goa, where, with his life, the greatest part of his fortune was lost. His mother, however, Anne de Macedo of Santarene, provided for the education of her son Louis at the university of Coimbra. What he acquired there, his works discover; an intimacy with the classics, equal to that of a Scaliger, but directed by the taste of a Milton or a Pope.

When he left the university, he appeared at court. He was handsome; had speaking eyes, it is said; and the finest complexion. Certain it is, however, he was a polished scholar, which, added to the natural ardour and gay vivacity of his disposition, rendered him an accomplished gentleman. Courts are the scenes of intrigue; and intrigue was fashionable at Lisbon. But the particulars of the amours of Camoens rest unknown. This only appears: he had aspired above his rank, for he was banished from the court; and in several of his sonnets he ascribes this misfortune to love.

He now retired to his mother's friends at Santarene. Here he renewed his studies, and began his poem on the discovery of India. John III. at this time prepared an armament against Africa. Camoens, tired of his inactive obscure life, went to Ceuta in this expedition, and greatly distinguished his valour in several rencounters. In a naval engagement with the Moors in the straits of Gibraltar, in the conflict of boarding, he was among the foremost, and lost his right eye. Yet neither hurry of actual service nor the dissipation of the camp could stifle his genius. He continued his *Lusiadas*, and several of his most beautiful sonnets were written in Africa, while as he expressed it,

One hand the pen, and one the sword, employed.

The fame of his valour had now reached the court, and he obtained permission to return to Lisbon. But, while he solicited an establishment which he had merited in the ranks of battle, the malignity of evil tongues, as he calls it in one of his letters, was injuriously poured upon him. Though the bloom of his early youth was effaced by several years residence under the scorching heavens of Africa, and though altered by the loss of an eye, his presence gave uneasiness to the gentlemen of some families of the first rank where he had formerly visited. Jealousy is the characteristic of the Spanish and Portuguese; its resentment knows no bounds, and Camoens now found it prudent to banish himself from his native country. Accordingly in 1553, he sailed for India, with a resolution never to return. As the ship left the Tagus, he exclaimed, in the words of the sepulchral monument of Scipio Africanus, *Ingrata patria, non possidebis ossa mea!* "Ungrateful

Camoens. ful country, thou ſhalt not poſſeſs my bones!" But he knew not what evils in the Eaſt would awake the remembrance of his native fields.

When Camoens arrived in India, an expedition was ready to ſail to revenge the king of Cochin on the king of Pimenta. Without any reſt on ſhore after his long voyage he joined this armament, and in the conqueſt of the Alagada iſlands diſplayed his uſual bravery.

In the year following, he attended Manual de Vaſconcello in an expedition to the Red Sea. Here, ſays Faria, as Camoens had no uſe for his ſword, he employed his pen. Nor was his activity confined in the fleet or camp. He viſited Mount Felex and the adjacent inhoſpitable regions of Africa, which he ſo ſtrongly pictures in the Luſiad, and in one of his little pieces where he laments the abſence of his miſtreſs.

When he returned to Goa, he enjoyed a tranquillity which enabled him to beſtow his attention on his Epic Poem. But this ſerenity was interrupted, perhaps by his own imprudence. He wrote ſome ſatires which gave offence; and by order of the viceroy Franciſco Barreto, he was baniſhed to China.

The accompliſhments and manners of Camoens ſoon found him friends, though under the diſgrace of baniſhment. He was appointed commiſſary of the defunct in the iſland of Macao, a Portugueſe ſettlement in the bay of Canton. Here he continued his Luſiad; and here alſo, after five years reſidence, he acquired a fortune, though ſmall, yet equal to his wiſhes. Don Conſtantine de Braganza was now viceroy of India; and Camoens, deſirous to return to Goa, reſigned his charge. In a ſhip, freighted by himſelf, he ſet ſail; but was ſhipwrecked in the gulph near the mouth of the river Mehon on the coaſt of China. All he had acquired was loſt in the waves: his poems, which he held in one hand, while he ſwimmed with the other, were all he found himſelf poſſeſſed of when he ſtood friendleſs on the unknown ſhore. But the natives gave him a moſt humane reception: this he has immortaliſed in the prophetic ſong in the tenth Luſiad; and in the ſeventh he tells us, that here he loſt the wealth which ſatisfied his wiſhes.

*Agora da eſperança ja adquirida, &c.*
Now bleſt with all the wealth fond hope could crave,
Soon I beheld that wealth beneath the wave
For ever loſt;——
My life, like Judah's heaven-doom'd king of yore,
By miracle prolong'd——

On the banks of the Mehon, he wrote his beautiful paraphraſe of the pſalm, where the Jews, in the fineſt ſtrain of poetry, are repreſented as hanging their harps on the willows by the rivers of Babylon, and weeping their exile from their native country. Here Camoens continued ſome time till an opportunity offered to carry him to Goa. When he arrived at that city, Don Conſtantine de Braganza, the viceroy, whoſe characteriſtic was politeneſs, admitted him into intimate friendſhip, and Camoens was happy till count Redondo aſſumed the government. Thoſe who had formerly procured the baniſhment of the ſatiriſt, were ſilent while Conſtantine was in power; but now they exerted all their arts againſt him. Redondo, when he entered on office, pretended to be the friend of Camoens; yet, with all that unfeeling indifference with which he made his moſt horrible witticiſm on the Zamorim, he ſuffered the innocent man to be thrown into the common priſon. After all the delay of bringing witneſſes, Camoens, in a public trial, fully refuted every accuſation of his conduct while commiſſary at Macao, and his enemies were loaded with ignominy and reproach, But Camoens had ſome creditors; and theſe detained him in priſon a conſiderable time, till the gentlemen of Goa began to be aſhamed that a man of his ſingular merit ſhould experience ſuch treatment among them. He was ſet at liberty; and again he aſſumed the profeſſion of arms, and received the allowance of a gentleman volunteer, a character at this time common in Portugueſe India. Soon after, Pedro Barreto, appointed governor of the fort at Sofala, by high promiſes, allured the poet to attend him thither. The governor of a diſtant fort, in a barbarous country, ſhares in ſome meaſure the fate of an exile. Yet, though the only motive of Baretto was, in this unpleaſant ſituation, to retain the converſation of Camoens at his table, it was his leaſt care to render the life of his gueſt agreeable. Chagrined with his treatment, and a conſiderable time having elapſed in vain dependence upon Barreto, Camoens reſolved to return to his native country. A ſhip, on the homeward voyage, at this time touched at Sofala, and ſeveral gentlemen who were on board were deſirous that Camoens ſhould accompany them. But this the governor ungenerouſly endeavoured to prevent, and charged him with a debt for board. Anthony de Cabra, however, and Hector de Sylveyra, paid the demand; and Camoens, ſays Faria, and the honour of Barreto, were ſold together.

After an abſence of 16 years, Camoens, in 1569, returned to Liſbon, unhappy even in his arrival, for the peſtilence then raged in that city, and prevented his publication for three years. At laſt, in 1572, he printed his Luſiad, which in the opening of the firſt book, in a moſt elegant turn of compliment, he addreſſed to his prince, king Sebaſtian then in his 18th year. The king, ſays the French tranſlator, was ſo pleaſed with his merit, that he gave the author a penſion of 4000 reals, on condition that he ſhould reſide at court. But this ſalary, ſays the ſame writer, was withdrawn by cardinal Henry, who ſucceeded to the crown of Portugal, loſt by Sebaſtian at the battle of Alcazar.

Though the great patron of one ſpecies of literature, a ſpecies the reverſe of that of Camoens, certain it is, that the author of the Luſiad was utterly neglected by Henry, under whoſe inglorious reign he died in all the miſery of poverty. By ſome, it is ſaid, he died in an alms-houſe. It appears, however, that he had not even the certainty of ſubſiſtence which theſe houſes provide. He had a black ſervant, who had grown old with him, and who had long experienced his maſters humanity. This grateful Indian, a native of Java, who, according to ſome writers ſaved his maſter's life in the unhappy ſhipwreck where he loſt his effects, begged in the ſtreets of Liſbon for the only man in Portugal on whom God had beſtowed thoſe talents which have a tendency to direct the ſpirit of a downward age. To the eye of a careful obſerver, the fate of Camoens throws great light on that of his country, and will appear ſtrictly connected with it. The ſame ignorance, the ſame degenerated ſpirit, which ſuffered Camoens to depend on his ſhare of the alms begged in the ſtreets by his old hoary ſervant,

vant, the same spirit which caused this, sunk the kingdom of Portugal into the most abject vassalage ever experienced by a conquered nation. While the grandees of Portugal were blind to the ruin which impended over them, Camoens beheld it with a pungency of grief which hastened his exit. In one of his letters he has these remarkable words: *Em fim accaberey a vida, e verram todos que fuy efeicoada a minho patria, &c.* "I am ending the course of my life, the world will witness how I have loved my country. I have returned, not only to die in her bosom, but to die with her."

In this unhappy situation, in 1579, in his 62d year, the year after the fatal defeat of Don Sebastian, died Louis de Camoens, the greatest literary genius ever produced by Portugal; in martial courage and spirit of honour, nothing inferior to her greatest heroes. And in a manner suitable to the poverty in which he died, was he buried.

CAMOMILE, in botany. See ANTHEMIS.

CAMP, the ground on which an army pitch their tents. It is marked out by the quarter master general, who appoints every regiment their ground.

The chief advantages to be minded in chusing a camp for an army, are, to have it near the water, in a country of forage, where the soldiers may find wood for dressing their victuals; that it have a free communication with garrisons, and with a country from whence it may be supplied with provisions; and, if possible, that it be situated on a rising ground, in a dry gravelly soil. Besides, the advantages of the ground ought to be considered, as marshes, woods, rivers, and inclosures; and if the camp be near the enemy, with no river or marsh to cover it, the army ought to be intrenched. An army always encamps fronting the enemy; and generally in two lines, running parallel about 500 yards distance; the horse and dragoons on the wings, and the foot in the centre; sometimes a body of two, three, or four brigades is encamped behind the two lines, and is called the *body of reserve*. The artillery and bread-waggons are generally encamped in the rear of the two lines. A battalion of foot is allowed 80 or 100 paces for its camp; and 30 or 40 for an interval betwixt one battalion and another. A squadron of horse is allowed 30 for its camp, and 30 for an interval, and more if the ground will allow it.

Where the grounds are equally dry, those camps are always the most healthful that are pitched on the banks of large rivers; because, in the hot season, situations of this kind have a stream of fresh air from the water, serving to carry off the moist and putrid exhalations. On the other hand, next to marshes, the worst encampments are on low grounds close beset with trees; for then the air is not only moist and hurtful in itself, but by stagnating becomes more susceptible of corruption. However, let the situation of camps be ever so good, they are frequently rendered infectious by the putrid effluvia of rotten straw, and the privies of the army; more especially if the bloody flux prevails, in which case the best method of preventing a general infection, is to leave the ground with the privies, foul straw, and other filth of the camp, behind. This must be frequently done, if consistent with the military operations: but when these render it improper to change the ground often, the privies should be made deeper than usual, and once a-day a thick layer of earth thrown into them till the pits are near full; and then they are to be well covered, and supplied by others. It may also be a proper caution to order the pits to be made either in the front or the rear, as the then stationary winds may best carry off the effluvia from the camp. Morever, it will be necessary to change the straw frequently, as being not only apt to rot, but to retain the infectious steams of the sick. But if fresh straw cannot be procured, more care must be taken in airing the tents, as well as the old straw.

The disposition of the Hebrew encampment was at first laid out by God himself. Their camp was of a quadrangular form, surrounded with an inclosure of the height of 10 hands-breadth. It made a square of 12 miles in compass about the tabernacle; and within this was another, called the *Levites camp*.

The Greeks had also their camps fortified with gates and ditches. The Lacedæmonians made their camp of a round figure, looking upon that as the most perfect and defensible of any form: we are not, however, to imagine, that they thought this form so essential to a camp, as never to be dispensed with when the circumstances of the place require it. Of the rest of the Grecian camps, it may be observed, that the most valiant of the soldiers were placed at the extremities, the rest in the middle. Thus we learn from Homer, that Achilles and Ajax were posted at the ends of the camp before Troy, as bulwarks on each side of the rest of the princes.

The figure of the Roman camp was a square divided into two principal parts: in the upper parts were the general's pavilion, or prætorium, and the tent of the chief officers; in the lower, those of inferior degree were placed. On one side of the prætorium stood the quæstorium, or apartment of the treasurer of the army; and near this the forum, both for a market place and the assembling of councils. On the other side of the prætorium were lodged the legati; and below it the tribunes had their quarters, opposite to their respective legions. Aside of the tribunes were the præfecti of the foreign troops, over against their respective wings; and behind these were the lodgments of the evocati, then those of the extraordinarii and ablecti equites, which concluded the higher part of the camp. Between the two partitions was a spot of ground called *principia*, for the altars and images of the gods, and probably also for the chief ensigns. The middle of the lower partition was assigned to the Roman horse; next to them were quartered the triarii; then the principes, and close by them the hastati; afterwards the foreign horse, and lastly the foreign foot. They fortified their camp with a ditch and parapet, which they termed *fossa* and *vallum*; in the latter some distinguish two parts, viz. the *agger* or earth, and the *sudes* or wooden stakes driven in to secure it. The camps were sometimes surrounded by walls made of hewn stone; and the tents themselves formed of the same matter.

In the front of the Turkish camp are quartered the janizaries and other foot, whose tents encompass their aga; in the rear are the quarters of the spahis and other horsemen. The body of the camp is possessed by the stately tents or pavilions of the vizer or general, rais effendi or chancellor, kahija or steward, the testerdar bashaw or lord treasurer, and kapislar kahiasee or master

master of the ceremonies. In the middle of these tents is a spacious field, wherein are erected a building for the divan, and a hasna or treasury. When the ground is marked out for a camp, all wait for the pitching of the tent *lailac*, the place where the courts of justice are held; it being the disposition of this that is to regulate all the rest.

The Arabs still live in camps, as the ancient Scenites did. The camp of the Assyne Emir, or king of the country about Tadmor, is described by a traveller who viewed it, as spread over a very large plain, and possessing so vast a space, that though he had the advantage of a rising ground he could not see the utmost extent of it. His own tent was near the middle; scarce distinguishable from the rest, except that it was bigger, being made, like the others, of a sort of hair-cloth.

Camp, is also used by the Siamese, and some other nations in the East Indies, as the name of the quarters which they assign to foreigners who come to trade with them. In these camps, every nation forms, as it were, a particular town, where they carry on all their trade, not only keeping all their warehouses and shops there, but also live in these camps with their whole families. The Europeans, however, are so far indulged, that at Siam, and almost every where else, they may live either in the cities or suburbs, as they shall judge most convenient.

*Camp fight, or Kamp fight*, in law writers, denotes the trial of a cause by duel, or a legal combat of two champions in the field, for decision of some controversy.

In the trial by camp fight, the accuser was, with the peril of his own body, to prove the accused guilty; and by offering him his glove, to challenge him to this trial, which the other must either accept of, or acknowledge himself guilty of the crime whereof he was accused.

If it were a crime deserving death, the camp fight was for life and death: if the offence deserved only imprisonment, the camp fight was accomplished when one combatant had subdued the other, so as either to make him yield or take him prisoner. The accused had liberty to choose another to fight in his stead, but the accuser was obliged to perform it in his own person, and with equality of weapons. No women were permitted to be spectators, nor men under the age of thirteen. The priest and the people who looked on, were engaged silently in prayer, that the victory might fall to him who had right. None might cry, shriek, or give the least sign; which in some places was executed with so much strictness, that the executioner stood ready with an axe to cut off the right hand or foot of the party that should offend herein.

He that, being wounded, yielded himself, was at the other's mercy either to be killed or suffered to live. But if life were granted him, he was declared infamous by the judge, and disabled from ever bearing arms, or riding on horseback.

CAMPAGNA. See Campania.

CAMPAIGN, in the art of war, denotes the space of time that an army keeps the field, or is encamped.—The beginning of every campaign is considerably more unhealthy than if the men were to remain in quarters. After the first fortnight or three weeks encampment, the sickness decreases daily; the most infirm being by that time in the hospitals, and the weather daily growing warmer. This healthy state continues throughout the summer, unless the men get wet clothes, or wet beds; in which case, a greater or less degree of the dysentery will appear in proportion to the preceding heats. But the most sickly part of the campaign begins about the middle or end of August, whilst the days are still hot, but the nights cool and damp, with fogs and dews: then, and not sooner, the dysentery prevails; and though its violence is over by the beginning of October, yet the remitting fever gaining ground, continues throughout the rest of the campaign, and never entirely ceases, even in winter-quarters, till the frosts begin. At the beginning of a campaign the sickness is so uniform, that the number may be nearly predicted; but for the rest of the season, as the diseases are then of a contagious nature, and depend so much upon the heats of summer, it is impossible to foresee how many may fall sick from the beginning to the end of autumn. It is also observed, that the last fortnight of a campaign, if protracted till the beginning of a campaign, is attended with more sickness than the first two months encampment: so that it is better to take the field a fortnight sooner, in order to return into winter-quarters so much the earlier. As to winter expeditions, though severe in appearance, they are attended with little sickness, if the men have strong shoes, quarters, fuel, and provisions. Long marches in summer are not without danger, unless made in the night, or so early in the morning as to be over before the heat of the day.



CAMPANACEÆ, in botany, an order of plants in the *Fragmenta methodi naturalis* of Linnæus, in which are the following genera, viz. convolvulus, ipomæa, polemonium, campanula, roella, viola, &c. *

* See Botany, p. 462.

CAMPANELLA, (Thomas) a famous Italian philosopher, born at Stilo in Calabria, in 1568. He distinguished himself by his steady proficiency in learning; for at the age of 13 he was a perfect master of the ancient orators and poets. His peculiar inclination was to philosophy, to which he at last confined his whole time and study. In order to arrive at truth, he shook off the yoke of authority: by which means the novelty of some of his opinions exposed him to many inconveniences; for at Naples he was thrown into prison, in which he remained 27 years, and during this confinement wrote his famous work entitled *Atheismus triumphatus*. Being at length set at liberty, he went to Paris, where he was graciously received by Louis XIII. and cardinal Richelieu; the latter procured him a pension of 2000 livres, and often consulted him on the affairs of Italy. Campanella passed the remainder of his days in a monastery of Dominicans at Paris, and died in 1639.

CAMPANI, (Matthew) of Spoletto, curate at Rome, wrote a curious treatise on the art of cutting glasses for spectacles, and made several improvements in optics, assisted by his brother and pupil Joseph. He died after 1678.

CAMPANIA, a town of Italy, in the kingdom of Naples, and in the farther principato, with a bishop's see. E. Long. 15. 30. N. Lat. 40. 40.

Campania, or *Campagna di Roma*, anciently Latium, a province of Italy, bounded on the west by the

Tiber and the sea, on the south-west by the sea, on the south by Terra di Lavoro, on the east by Abruzzo, and on the north by Sabina. Though the soil is good, it produces little or nothing, on account of the heavy duties on corn; and though the waters are good the air is unwholesome. It is subject to the Pope, and is about 60 miles in length on the Mediterranean sea.

It hath been generally thought that the air of this country hath something in it peculiarly noxious during the summer-time; but Mr Condamine is of opinion that it is not more unhealthy than any other marshy country. His account follows. "It was after the invasion of the Goths in the fifth and sixth centuries that this corruption of the air began to manifest itself. The bed of the Tiber being covered by the accumulated ruins of the edifices of ancient Rome, could not but raise itself considerably. But what permits us not to doubt of this fact is, that the ancient and well-preserved pavement of the pantheon and its portico is overflowed every winter; that the water even rises there sometimes to the height of eight or ten feet; and that it is not possible to suppose that the ancient Romans should have built a temple in a place so low as to be covered with the waters of the Tiber on the least inundation. It is evident, then, that the level of the bed of this river is raised several feet, which could not have happened without forming there a kind of dikes or bars. The choaking up of its canal necessarily occasioned the overflow and reflux of its waters in such places as till then had not been subject to inundations: to these overflowings of the Tiber were added all the waters that escaped out of the ancient aqueducts, the ruins of which are still to be seen, and which were entirely broken and destroyed by Totila. What need, therefore, of any thing more to infect the air, in a hot climate, than the exhalations of such a mass of stagnating waters, deprived of any discharge, and become the receptacle of a thousand impurities, as well as the grave of several millions both of men and animals? The evil could not but increase from the same causes while Rome was exposed to the incursions and devastations of the Lombards, the Normans, and the Saracens, which lasted for several centuries. The air was become so infectious there at the beginning of the 13th century, that Pope Innocent III. wrote, that few people at Rome arrived to the age of forty years, and that nothing was more uncommon there than to see a person of sixty. A very short time after, the popes transferred the seat of their residence to Avignon: during the seventy-two years they remained there, Rome became a desert; the monasteries in it were converted into stables; and Gregory XI. on his return to Rome in 1336, hardly counted there 30,000 inhabitants. At his death began the troubles of the great schism in the west, which continued for upwards of 50 years. Martin V. in whom this schism ended in the year 1429, and his first successors, were able to make but feeble efforts against so inveterate an evil. It was not till the beginning of the 16th century that Leo X. under whom Rome began to resume her wonted splendor, gave himself some trouble about re-establishing the salubrity of the air: but the city being shortly after besieged twice successively by the emperor Charles V. saw itself plunged again into all its old calamities; and from 85,000 inhabitants, which it contained under Leo X. it was reduced under Clement VIII. to 32,000. In short, it is only since the time of Pius V. and Sextus V. at the end of the 16th century, that the popes have constantly employed the necessary methods for purifying the air of Rome and its environs, by procuring proper discharges for the waters, drying up humid and marshy grounds, and covering the banks of the Tiber and other places reputed uninhabitable with superb edifices. Since that time a person may dwell at Rome, and go in or out of it at all seasons of the year. At the beginning, however, of the present century, they were still afraid to lie out of the city in summer, when they had resided there; as they were also to return to it, when once they had quitted it. They never ventured to sleep at Rome, even in broad day, in any other house than their own. They are greatly relaxed at present from these ancient scruples: I have seen cardinals, in the months of July and August, go from Rome to lie at Frascati, Tivoli, Albano, &c. and return the next or the following days to the city, without any detriment to their health: I have myself tried all these experiments, without suffering the least inconvenience from them: we have even seen, in the last war in Italy, two armies encamped under the walls of Rome at the time when the heats were most violent. Yet, notwithstanding all this, the greatest part of the country people dare not still venture to lie during that season of the year, nor even as much as sleep in a carriage, in any part of the territory comprehended under the name of the *Campagna of Rome*."



CAMPANIFORM, or CAMPANULATED, an appellation given to flowers resembling a bell.

CAMPANINI, a name given to an Italian marble dug out of the mountains of Carrara, because, when it is worked, it sounds like a bell.

CAMPANULA, or BELL-FLOWER; a genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 29th order, *Campanaceæ*. The corolla is campanulated, with its fundus closed up by the valves that support the stamina; the stigma is trifid; the capsule inferior, or below the receptacle of the flower, opening and emitting the seeds by lateral pores.

*Species*. Of this genus there are no fewer than 41 species enumerated by botanical writers; but the following are the most worthy of attention. 1. The pyramidalis hath thick tuberous roots filled with a milky juice; it sends out strong, smooth, upright stalks, which rise to the height of four feet, garnished with smooth oblong leaves a little indented at the edges. The flowers are produced from the side of the stalks, and are regularly set on for more than half their length, forming a sort of pyramid; these are large, open, and shaped like a bell. The most common colour of the flowers is blue, though some are white, but the former are most esteemed. 2. The decurrens, or peach-leaved bell-flower, is a native of the northern parts of Europe; of this there are some with white, and some with blue flowers, and some with double flowers of both colours. These last have of late been propagated in such abundance as to have almost banished from the gardens those with single flowers. 3. The medium, commonly called *Canterbury bell-flower*, is a biennial plant, which perishes soon after it has ripened its seeds. It grows naturally in the woods of Italy and Austria; but is cul-

Campanula cultivated in the British gardens for the beauty of its flowers, which are blue, purple, white, and striped, with double flowers of all the colours. This species hath oblong, rough, hairy leaves, serrated on their edges; from the centre of these rises a stiff, hairy, furrowed stalk, about two feet high, sending out several lateral branches, garnished with long, narrow, hairy leaves sawed on their edges. From the setting on of these leaves proceed the footstalks of the flower; those which are on the lower part of the stalk and branches diminishing gradually in their length upward, and thereby forming a sort of pyramid. The flowers of this kind are very large, so make a fine appearance. The seeds ripen in September, and the plants decay soon after. 4. The trachelium, with nettle leaves, hath a perennial root, which sends up several stiff hairy stalks having two ribs or angles. These put out a few short side-branches, garnished with oblong hairy leaves deeply sawed on their edges. Toward the upper part of the stalks, the flowers came out alternately upon short trifid foot-stalks having hairy empalements. The colours of the flowers are a deep and a pale blue and white, with double flowers of the same; the double flowered kind only merit a place in gardens. 5. The latifolia, or greatest bell-flower, hath a perennial root, composed of many fleshy fibres that abound with a milky juice. From these arise several strong, round single stalks, which never put out branches, but are garnished with oval spear-shaped leaves slightly indented on their edges. Towards the upper part of the stalk the flowers come out singly upon short foot-stalks; their colours are blue, purple, and white. 6. The rapunculus, or rampion, hath roundish fleshy roots, which are eatable, and much cultivated in France for sallads; some years past it was cultivated in the English gardens for the same purpose, but is now generally neglected. It is a native of Britain: but the roots of the wild sort never grow to half the size of those which are cultivated. 7. The speculum, with yellow eye-bright leaves, is an annual plant with slender stalks rising a foot high, branching out on every side, and garnished with oblong leaves a little curled on their edges; from the wings of the leaves come out the flowers sitting close to the stalks, which are of a beautiful purple inclining to a violet colour. In the evening, they contract and fold into a pentagonal figure; from whence it is by some called *viola pentagonia*, or *five-cornered violet*. 8. The hybrida, or common Venus looking-glass. This seldom rises more than six inches high, with a stalk branching from the bottom upward, and garnished with oval leaves sitting close to the stalks, from the base of which the branches are produced, which are terminated by flowers very like the former sort. This was formerly cultivated in the gardens: but since the former kind hath been introduced, it hath almost supplanted this; for the other is a much taller plant, and the flowers larger, though of a less beautiful colour. 9. The canariensis, with an orach leaf and tuberous root, is a native of the Canary islands. It hath a thick fleshy root of an irregular form; sometimes running downward like a parsnip, at other times dividing into several knobs near the top; and when any part of the root is broken, there issues out a milky juice at the wound. From the head or crown of the root arise one, two, three, or more stalks, in proportion to the size of the root: but that in the centre is Campanula generally larger and rises higher, than the others. These stalks are very tender, round, and of a pale green; their joints are far distant from each other; and when the roots are strong, the stalks will rise to ten feet high, sending out several lateral branches. At each joint they are garnished with two, three or four spear-shaped leaves, with a sharp pointed beard on each side. They are of a sea-green; and, when they first come out, are covered slightly with an ash-coloured pounce. From the joints of the stalk the flowers are produced, which are of the perfect bell-shape, and hang downward; they are of a flame-colour, marked with stripes of a brownish red: the flower is divided into five parts; at the bottom of each is seated a nectarium, covered with a white transparent skin, much resembling those of the crown imperial, but smaller. The flowers begin to open in the beginning of October, and there is often a succession of them till March. The stalks decay to the root in June, and new ones spring up in August.

*Culture*, &c. The first sort is cultivated to adorn halls, and to place before chimnies in the summer when it is in flower, for which purpose there is no plant more proper; for when the roots are strong, they will send out four or five stalks which will rise as many feet high, and are adorned with flowers a great part of their length. When the flowers begin to open, the pots are removed into the rooms, where, being shaded from the sun and rain, the flowers will continue long in beauty; and if the pots are every night removed into a more airy situation, but not exposed to heavy rains, the flowers will be fairer, and continue much longer in beauty. Those plants which are thus treated, are seldom fit for the purpose the following season; therefore a supply of young ones must be annually raised. The plant may be propagated either by dividing the roots or by seeds, but the latter produce the most vigorous and best flowering plants. The seeds must be sown in autumn in boxes or pots filled with light undunged earth, and placed in the open air till the frost or hard rains come on: then they must be placed under a hot-bed frame, where they may be sheltered from both; but in mild weather the glasses should be drawn off every day, that they may enjoy the free air: with this management the plants will come up early in the spring, and then they must be removed out of the frame, placing them first in a warm situation; but, when the season becomes warm, they should be so placed as to have the morning sun only. In September the leaves of the plants will begin to decay, at which time they should be transplanted; therefore there must be one or two beds prepared, in proportion to the number of plants. These beds must be in a warm situation, and the earth light, sandy, and without any mixture of dung. The plants must then be taken out of the pots or cases very carefully, so as not to bruise their roots; for they are very tender, and on being broken the milky juice will flow out plentifully, which will greatly weaken them. These should be planted at about six inches distance each way, with the head or crown of the root half an inch below the surface. If the season proves dry, they must be gently watered three or four days after they are planted; the beds should also be covered with mats in the day time, but

Campanula which ſhould be taken off at night to let the dew fall on the plants. Towards the end of November the beds ſhould be covered over with ſome old tanners bark to keep out the froſt; and where there is not conveniency for covering them with frames, they ſhould be arched over with hoops, that in ſevere weather they may be covered with mats. In the ſpring the mats muſt be removed, and, the following ſummer, the plants kept free from weeds. In autumn the earth ſhould be ſtirred between them, ſome freſh earth ſpread over the beds, and the plants covered in winter as before. In theſe beds the plants may remain two years, during which time they are to be treated in the manner before directed. The roots will now be ſtrong enough to flower; ſo, in September they ſhould be carefully taken up, and ſome of the moſt promiſing carefully planted in pots; the others may be planted in warm borders, or in a freſh bed, at a greater diſtance than before, to allow them room to grow. Thoſe plants which are potted ſhould be ſheltered in winter from great rains and hard froſts, otherwiſe they will be in danger of rotting, or at leaſt will be ſo weakened as not to flower with any ſtrength the following ſummer; and thoſe which are planted in the full ground, ſhould have ſome old tanners bark laid round them to prevent the froſt from getting at the roots. The ſecond, third, fourth, and fifth ſorts are ſo eaſily propagated by parting the roots, or by ſeeds, that no particular directions for their culture need be given. The ſixth ſort, which is cultivated for its eſculent roots, may be propagated by ſeeds, which are to be ſown in a ſhady border; and when the plants are about an inch high, the ground ſhall be hoed as is practiſed for onions, to cut up the weeds, and thin the plants, to the diſtance of three or four inches; and when the weeds come up again they muſt be hoed over to deſtroy them: this, if well performed in dry weather, will make the ground clean for a long time; ſo that, being three times repeated, it will keep the plants clean till winter, which is the ſeaſon for eating the roots, when they may be taken up for uſe as wanted. They will continue good till April, at which time they ſend out their ſtalks, when the roots become hard and unfit for uſe.—The ſeventh and eighth ſorts are eaſily propagated by ſeeds, which they produce in plenty. If theſe, and the Venus navelwort, dwarf lychnis, candy-tuft, and other low annual flowers, are properly mixed in the border of the flower-garden, and ſown at two or three different ſeaſons, ſo as to have a ſucceſſion of them in flower, they will make an agreeable variety. If theſe ſeeds are ſown in autumn, the plants will flower early in the ſpring; but if ſown in the ſpring, they will not flower till the middle of June; and if a third ſowing is performed about the middle of May, the plants will flower in Auguſt; but from theſe, good ſeeds muſt not be expected.—The ninth ſort is propagated by parting the roots, which muſt be done with caution: for if they are broken or wounded, the milky juice will flow out plentifully; and if planted before the wounds are ſkinned over, it occaſions their rotting: therefore when any of them are broken, they ſhould be laid in the green-houſe a few days to heal. Theſe roots muſt not be too often parted, if they are expected to flower well; for by this means they are weakened. The beſt time for tranſplanting and parting their roots is in July, ſoon after the ſtalks are decayed. They muſt not be planted in rich earth, otherwiſe they will be very luxuriant in branches, and have but few flowers. They ſucceed beſt in a light ſandy loam, mixed with a fourth part of ſcreened lime-rubbiſh: when the roots are firſt planted the pots ſhould be placed in the ſhade, and unleſs the ſeaſon is very dry they ſhould not be watered; for during the time they are inactive, wet is very injurious to them. About the middle of Auguſt, the roots will begin to put out fibres; at which time, if the pots are placed under a hot bed frame, and, as the nights grow cool, covered with the glaſſes, but opened every day to enjoy the free air, it will greatly forward them for flowering, and increaſe their ſtrength: when the ſtalks appear, they muſt be now and then refreſhed with water; but it muſt not be given too often, nor in too great quantity. The plants thus managed, by the middle of September will have grown ſo tall as not to be kept any longer under the glaſs frame; they muſt, therefore, be removed into a dry airy glaſs-caſe, where they may enjoy the free air in mild weather, but ſcreened from the cold. During the winter ſeaſon they muſt be frequently refreſhed with water, and guarded from froſt; and, in the ſpring, when the ſtalks begin to decay, the pots ſhould be ſet abroad in the ſhade, and not watered.

Campbell. CAMPBELL, (Archiband) earl and marquis of Argyle, was the ſon of Archibald earl of Argyle, by the lady Anne Douglaſs, daughter of William earl of Morton. He was born in the year 1598; and educated in the profeſſion of the Proteſtant religion, according to the ſtricteſt rules of the church of Scotland, as it was eſtabliſhed immediately after the reformation. During the commonwealth he was induced to ſubmit to its authority. Upon the reſtoration, he was tried for his compliance; a crime common to him with the whole nation, and ſuch a one as the moſt loyal and affectionate ſubject might frequently by violence be induced to commit. To make this compliance appear the more voluntary and hearty, there were produced in court letters which he had wrote to Albermarle, while that general governed Scotland, and which contained expreſſions of the moſt cordial attachment to the eſtabliſhed government. But, beſides the general indignation excited by Albermarle's diſcovery of this private correſpondence, men thought, that even the higheſt demonſtrations of affection might, during jealous times, be exacted as a neceſſary mark of compliance from a perſon of ſuch diſtinction as Argyle; and could not, by any equitable conſtruction, imply the crime of treaſon. The parliament, however, ſcrupled not to paſs ſentence upon him, and he ſuffered with great conſtancy and courage.

CAMPBELL, (Archibald) earl of Argyle, ſon to the former, had from his youth diſtinguiſhed himſelf by his loyalty and his attachment to the royal family. Tho' his father was head of the covenanters, he himſelf refuſed to concur in any of their meaſures; and when a commiſſion of colonel was given him by the convention of ſtates, he forbore to act upon it till it ſhould be ratified by the king. By his reſpectful behaviour, as well as by his ſervices, he made himſelf acceptable to Charles when that prince was in Scotland and even after the battle of Worceſter, all the misfortunes which attended the royal cauſe could not engage him to deſert it. Un-

Campbell. der Middeton he obstinately persevered to harass and infest the victorious English; and it was not till he received orders from that general, that he would submit to accept of a capitulation. Such jealousy of his loyal attachments was entertained by the commonwealth and protector, that a pretence was soon after fallen upon to commit him to prison; and his confinement was rigorously continued till the restoration. The king, sensible of his services, had remitted to him his father's forfeiture, and created him earl of Argyle; and when a most unjust sentence was passed upon him by the Scots parliament, Charles had anew remitted it. In the subsequent part of this reign Argyle behaved himself dutifully; and though he seemed not disposed to go all lengths with the court, he always appeared, even in his opposition, a man of mild dispositions and peaceable deportment.

A parliament was summoned at Edinburgh in summer 1681, and the duke was appointed commissioner. Besides granting money to the king, and voting the indefeasible right of succession, this parliament enacted a test, which all persons possessed of offices, civil, military, or ecclesiastical, were bound to take. In this test the king's supremacy was asserted, the covenant renounced, passive obedience assented to, and all obligations disclaimed of endeavouring any alteration in civil or ecclesiastical establishments. This was the state of the test as proposed by the courtiers; but the country party proposed also a clause of adherence to the Protestant religion, which could not with decency be rejected. The whole was of an enormous length, considered as an oath; and, what was worse, a confession of faith was there ratified which had been imposed a little after the reformation, and which contained many articles altogether forged by the parliament and nation. Among others, the doctrine of resistance was inculcated; so that the test being voted in a hury, was found on examination to be a medley of absurdity and contradiction. Though the courtiers could not reject the clause of adhering to the Protestant religion, they proposed, as a requisite mark of respect, that all princes of the blood should be exempted from taking that oath. This exception was zealously opposed by Argyle; who observed that the sole danger to be dreaded for the Protestant religion must proceed from the perversion of the royal family. By insisting on such topics, he drew on himself the secret indignation of the duke of York, of which he soon felt the fatal consequences.

When Argyle took the test as a privy counsellor, he subjoined, in the duke's presence, an explanation which he had before hand communicated to that prince, and which he believed to have been approved by him. It was in these words. "I have considered the test, and am very desirous of giving obedience as far as I can. I am confident that the parliament never intended to impose contradictory oaths: therefore I think no man can explain it but for himself. Accordingly I take it as far as it is consistent with itself and the Protestant religion. And I do declare that I mean not to bind myself, in my station, and in a lawful way, from wishing and endeavouring any alteration, which I think to the advantage of church or state, and not repugnant to the Protestant religion and my loyalty: and this I understand as a part of my oath." The duke, as was natural, heard it with great tranquillity: no one took the least offence: Argyle was admitted to sit that day in council: and it was impossible to imagine that a capital offence had been committed, where occasion seemed not to have been given so much as for a frown or reprimand.

Argyle was much surprised a few days after, to find that a warrant was issued for committing him to prison; that he was indicted for high treason, leasing-making, and perjury; and that from the innocent words abovementioned an accusation was extracted, by which he was to forfeit life, honours, and fortune. It is needless to enter into particulars, where the iniquity of the whole is so evidently apparent. Though the sword of justice was displayed, even her semblance was not put on; and the forms of law were preserved to sanctify, or rather aggravate, the oppression. Of five judges, three did not scruple to find the guilt of treason and leasing-making to be incurred by the prisoner: a jury of 15 noblemen gave verdict against him; and the king being consulted, ordered the sentence to be pronounced, but the execution of it to be suspended till further orders. Argyle, however, saw no reason to trust to the justice or mercy of such enemies: He made his escape from prison, and till he could find a ship for Holland he concealed himself during some time in London. The king heard of his lurking-place, but would not suffer him to be arrested. All the parts, however, of his sentence, so far as the government in Scotland had power, were rigorously executed; his estate confiscated, his arms reversed and torn. Having got over to Holland, he remained there during the remaining part of the reign of Charles II. But thinking himself at liberty, before the coronation of James II. to exert himself in order to recover the constitution by force of arms, he concerted measures with the duke of Monmouth, and went into Scotland, to assemble his friends: but not meeting with the success he expected, he was taken prisoner; and being carried to Edinburgh, was beheaded upon his former unjust sentence, June 30, 1615. He showed great constancy and courage under his misfortunes: on the day of his death he ate his dinner very cheerfully: and, according to custom, slept after it a quarter of an hour or more, very soundly. At the place of execution, he made a short, grave, and religious speech; and, after solemnly declaring that he forgave all his enemies, submitted to death with great firmness.

Campbell, (Archibald) first duke of Argyle, son to the preceding, was an active promoter of the revolution. He came over with the Prince of Orange; was admitted into the convention as Earl of Argyle, tho' his father's attainder was not reversed; and in the claim of rights the sentence against him was declared to be, what most certainly it was, a reproach upon the nation. The establishment of the crown upon the Prince and Princess of Orange being carried by a great majority in the Scottish convention, the earl was sent from the nobility with Sir James Montgomery and Sir John Dalrymple from the barons and boroughs, to offer the crown, in the name of the convention, to their Majesties, and tendered them the coronation oath; for which, and many other eminent services, he was admitted a member of the privy council, and, in 1690, made one of the Lords of the Treasury. He was afterwards

Campbell. terwards made a colonel of the Scots horse guards; and, in 1694, one of the extraordinary Lords of Session. He was likewise created Duke of Argyle, Marquis of Kintyre and Lorn, Earl of Campbell and Cowell, Viscount of Lochow and Glengla, Lord Inverary, Mull, Morvern, and Terrey, by letters-patent, bearing date at Kensington the 23d of June 1701. He sent over a regiment to Flanders for king William's service, the officers of which were chiefly of his own name and family, who bravely distinguished themselves through the whole course of the war. He married Elizabeth, daughter of Sir Lionel Talmash of Helmingham in the county of Suffolk, by Elizabeth duchess of Lauderdale his wife, daughter and heir of William Murray earl of Dysart, by whom he left issue two sons and a daughter; namely, John duke of Argyle, the subject of the next article; Archibald, who succeeded his brother as Duke of Argyle; and Lady Anne, married to James Stuart, second earl of Bute, by whom she had the present earl.

Campbell, (John) second duke of Argyle, and also duke of Greenwich and baron of Chatham, son to the subject of the preceding article, was born on the 10th of October 1680; and, on the very day when his grandfather suffered at Edinburgh, fell out of a window three pair of stairs high without receiving any hurt. At the age of 15, he had made a considerable progress in classical learning. His father then perceived and encouraged his military disposition, and introduced him to king William, who in the year 1694 gave him the command of a regiment. In this situation he remained till the death of his father in 1703; when becoming duke of Argyle, he was soon after sworn of queen Anne's privy council, made captain of the Scotch horse guards, and appointed one of the extraordinary lords of session. In 1704, her Majesty reviving the Scottish order of the thistle, his grace was installed one of the knights of that order, and was soon after appointed high-commissioner to the Scotch parliament; where, being of great service in promoting the intended union, he was on his return created a peer of England, by the titles of *baron of Chatham* and *earl of Greenwich*, and in 1710 was made knight of the garter. His grace first distinguished himself in his military capacity at the battle of Oudenard; where he commanded as brigadier-general, with all the bravery of youth and the conduct of a veteran officer. He was present under the duke of Marlborough at the siege of Ghent, and took possession of the town. He had also a considerable share in the victory obtained over the French at the battle of Malplaquet, by dislodging them from the wood of Sart, and gaining a post of great consequence. In this sharp engagement, several musket-balls passed through the duke's clothes, hat, and peruke. Soon after this hot action, he was sent to take the command in Spain; and after the reduction of Port Mahon, he returned to England. His grace having now a seat in the house of lords, he censured the measures of the ministry with such freedom, that all his places were disposed of to other noblemen: but at the accession of George I. he recovered his influence. At the breaking out of the rebellion in 1715, he was made commander in chief of his majesty's forces in North Britain; and was the principal means and cause of the total extinction, at that time, of the rebellion in Scotland, without much bloodshed. In direct opposition to him, or that part of the army he commanded, at the head of all his Campbells, was placed Campbell earl of Braidalbin, of the same family and kindred, by some fatal error that ever misguided and misled that unhappy family of the Stuarts and all its adherents. The consequence was, that both sets of Campbells, from family affection, refused to strike a stroke, and retired out of the battle. He arrived at London March 6th 1716, and was in high favour: but, to the surprise of people of all ranks, he was in a few months divested of all his employments: and from this period to the year 1718, he signalized himself in a civil capacity, by his uncorrupted patriotism and manly eloquence. In the beginning of the year 1719, he was again admitted into favour, appointed lord-steward of the houshold, and in April following was created duke of Greenwich. He continued in the administration during all the remaining part of that reign; and, after his late majesty's accession, till April 1740; when he delivered a speech with such warmth, that the ministry being highly offended, he was again dismissed from his employments. To these, however, on the change of the ministry, he was soon restored; but not approving of the measures of the new ministry more than those of the old, he gave up all his posts for the last time, and never after engaged in affairs of state. He now enjoyed privacy and retirement; and died of a paralytic disorder on the 4th of October 1743. To the memory of his grace a very noble monument was erected in Westminster-Abbey, executed by the ingenious Roubilliac.

The duke of Argyle, though never first minister, was a very able statesman and politician, most steadily fixed in those principles he believed to be right, and not to be shaken or changed. His delicacy and honour were so great, that it hurt him to be even suspected; witness that application said to be made to him by one of the adherents of the Stuart family before the last rebellion in order to gain his interest, which was considerable both in Scotland and England. He immediately sent the letter to the secretary of state; and it vexed him much even to have an application made him, lest any person should think him capable of acting a double part. When he thought measures wrong or corrupt, he cared not who was the author, however great or powerful he might be; witness his boldly attacking the great duke of Marlborough in the house of lords, about his forage and army contracts in Flanders, in the very zenith of his power and popularity, though in all other respects he was the most able general of his time. The duke of Argyle, on all occasions, spoke well, with a firm, manly, and noble eloquence; and seems to deserve the character given of him by Pope:

> Argyle the state's whole thunder born to weild,
> And shake alike the senate and the field.

In private life, the duke's conduct was highly exemplary. He was an affectionate husband and an indulgent master. He seldom parted with his servants till age had rendered them incapable of their employments; and then he made provision for their subsistence. He was liberal to the poor, and particularly to persons of merit in distress: but though he was ready to patronize deserving persons, he was extremely cau-

tious

Campbell. tious not to deceive any by lavish promises, or leading them to form vain expectations. He was a strict œconomist, and paid his tradesmen punctually every month; and though he maintained the dignity of his rank, he took care that no part of his income should be wasted in empty pomp or unnecessary expences. He was twice married; and left five daughters, but no male issue. The titles of duke and earl of Greenwich and baron of Chatham became extinct at his death; but in his other titles he was succeeded by his brother Archibald earl of Ila, the subject of the next article.

Campbell, (Archibald) third Duke of Argyle, brother, to the subject of the preceding article, was born at Hamhouse, in England, in June 1682, and was educated at the University of Glasgow. He afterwards applied himself to the study of the law at Utretcht; but upon his father's being created a Duke he betook himself to a military life, and served some time under the duke of Marlborough. Upon quitting the army, in which he did not long remain, he applied to the acquisition of that knowledge which would enable him to make a figure in the political world. In 1705, he was constituted treasurer of Scotland, and made a considerable figure in Parliament, though he was not more than twenty-three years of age. In 1706, he was appointed one of the commissioners for treating of the Union; and the same year was created Lord Ornsay, Dunoon, and Arrois, Viscount and Earl of Islay. In 1708, he was made an extraordinary Lord of Session; and when the Union was effected, he was chosen one of the Sixteen Peers for Scotland, in the first Parliament of Great-Britain; and was constantly elected to every future Parliament till his death, except the fourth. In 1710, he was made Justice-General of Scotland. In 1711, he was called to the privy council; and upon the accession of George I. he was nominated lord register of Scotland. When the rebellion broke out in 1715, he again betook himself to arms, in defence of the house of Hanover, and by his prudent conduct in the West Highlands, he prevented General Gordon, at the head of three thousand men, from penetrating into the country, and raising levies. He afterwards joined his brother at Stirling, and was wounded at the battle of Dumblain. In 1725, he was appointed keeper of the privy seal; and, from this time, he was entrusted with the management of Scottish affairs. In 1734, upon his resigning the privy seal, he was made keeper of the great seal, which office he enjoyed till his death. Upon the decease of his brother, he became duke of Argyle, hereditary justice general, lieutenant, sheriff, and commissary of Argyleshire and the Western Isles, hereditary great master of the houshold, hereditary keeper of Dunstaffnage, Carrick, and several other castles. He was also chancelor of the University of Aberdeen; and laboured to promote the interest of that, as well as of the other universities of Scotland. He particularly encouraged the school of physic at Edinburgh, which has now acquired so high a reputation. Having the chief management of Scotch affairs, he was also extremely attentive to promote the trade, manufactures, and improvements of his country. It was by his advice that, after the rebellion in 1745, the Highlanders were employed in the royal army. He was a man of great endowments both natural and acquired, well versed in the laws of his country, and possessed considerable parliamentary abilities. He was Campbell. likewise eminent for his skill in human nature, had great talents for conversation, and had collected one of the most valuable private libraries in Great-Britain. He built himself a very magnificient seat at Inverary. The faculties of his mind continued sound and vigorous till his death, which happened suddenly on the 15th of April 1761, in the 79th year of his age. He was married, but had no issue; and was succeeded in his titles and the estates of his family by John Campbell, fourth duke of Argyle, son of the honourable John Campbell of Mammore, who was the second son of Archibald the ninth earl of Argyle.

The family of Argyle was heritable justice-general for Scotland till abolished by the jurisdiction act. They are still heritable masters of the king's houshould in Scotland, and keepers of Dunstaffnage and Carrick.

Campbell, (John) an eminent historical, biographical, and political writer, was born at Edinburgh, March 8, 1707-8. His father, Robert Campbell of Glenlyon, Esq; was captain of horse in a regiment commanded by the then earl of Hyndford, and his mother Elizabeth, daughter of —— Smith, Esq; of Windsor in Berkshire, had the honour of claiming a descent from the poet Waller. Our author, their fourth son, was at the age of five years brought from Scotland in Windsor, where he received the first principles of his education; and at a proper age, he was placed out as a clerk to an attorney, being intended for the law. This profession, however, he never followed; but by a close application to the acquisition of knowledge of various kinds, became qualified to appear with great advantage in the literary world. In 1736, before he had completed his 30th year, he gave to the public, in two volumes folio, "The Military History of Prince Eugene and the Duke of Marlborough," enriched with maps, plans, and cuts. The reputation hence acquired, occasioned him soon after to be solicited to take a part in the "Ancient Universal History." Whilst employed in this capital work Mr Campbell found leisure to entertain the world with other productions. In 1739, he published the "Travels and Adventures of Edward Brown, Esq;" 8vo. In the same year appeared his, "Memoirs of the Bashaw Duke de Ripperda," 8vo, reprinted with improvements, 1740. These memoirs were followed, in 1741, by the "Concise History of Spanish America," 8vo. In 1742, he was the author of "A Letter to a Friend in the Country, on the Publication of Thurloe's State Papers;" giving an account of their discovery, importance and utility. The same year was distinguished by the appearance of the 1st and 2d volumes of his "Lives of the English Admirals, and other eminent British Seamen." The two remaining volumes were completed in 1744; and the whole, not long after, was translated into German. This was the first of Mr Campbell's works to which he prefixed his name; and it is a performance of great and acknowledged merit. In 1743, he published "Hermippus revived;" a second edition of which, much improved and enlarged, came out in 1749, under the following title: "Hermippus Redivivus: or the Sage's Triumph over old Age and the Grave. Wherein a method is laid down for prolonging the life and vigour of man. Including a commentary upon an ancient Inscription, in which this great secret is revealed; sup-



ported

Campbell. ported by numerous authorities. The whole interspersed with a great variety of remarkable and well-attested relations." This extraordinary tract had its origin in a foreign publication: but it was wrought up to perfection by the additional ingenuity and learning of Mr Campbell. In 1744, he gave to the public in two volumes folio, his "Voyages and Travels," on Dr Harris's plan, being a very distinguished improvement of that collection which had appeared in 1705. The time and care employed by Mr Campbell in this important undertaking, did not prevent his engaging in another great work, the "Biographia Britannica," which began to be published in weekly numbers in 1745, and extended to seven volumes folio: but our author's articles were only in the first four volumes; of which Dr Kippis observes, they constitute the prime merit.

When the late Mr Dodsley formed the design of "The Preceptor," which appeared in 1748, Mr Campbell was to assist in the undertaking; and the parts written by him were the Introduction to Chronology, and the Discourse on Trade and Commerce, both of which displayed an extensive fund of knowledge upon these subjects. In 1750, he published the first separate edition of his "Present State of Europe;" a work which had been originally begun in 1746, in the "Museum," a very valuable periodical performance printed for Dodsley. There is no production of our author's that hath met with a better reception. It has gone through six editions, and fully deserved this encouragement. The next great undertaking which called for the exertion of our author's abilities and learning, was "The Modern Universal History." This extensive work was published, from time to time, in detached parts, till it amounted to 16 volumes folio; and a second edition of it, 8vo, began to make its appearance in 1759. The parts of it written by Mr Campbell were the histories of the Portuguese, Dutch Spanish, French, Swedish, Danish, and Ostend Settlements in the East-Indies; and the Histories of the Kingdoms of Spain, Portugal, Algarve, Navarre, and that of France, from Clovis to 1656. As our author had thus distinguished himself in the literary world, the degree of LL.D. was very properly and honourably conferred upon him, June 18, 1754, by the university of Glasgow.

His principal and favourite work was, "A political survey of Great-Britain," 2 vol, 4to, published a short time before his death; in which the extent of his knowledge, and his patriotic spirit, are equally conspicuous. Dr Campbell's reputation was not confined to his own country, but extended to the remotest parts of Europe. As a striking instance of this, it may be mentioned, that in the spring of 1774, the empress of Russia was pleased to honour him with the present of her picture, drawn in the robes worn in that country in the days of John Basiliowitz, grand duke of Muscovy, who was contemporary with queen Elizabeth. To manifest the doctor's sense of her imperial majesty's goodness, a sett of the "Political Survey of Britain," bound in Morocco, highly ornamented, and accompanied with a letter descriptive of the triumphs and felicities of her reign, was forwarded to St Petersburg, and conveyed into her hands by prince Orloff, who had resided some months in Britain.

Campbell || Campbell-town.

Dr Campbell in 1736 married Elizabeth, daughter of Benjamine Vobe, of Leominster, in the county of Hereford, gentleman, with whom he lived nearly 40 years in the greatest conjugal harmony and happiness. So wholly did he dedicate his time to books, that he seldom went abroad: but to relieve himself as much as possible from the inconveniences incident to a sedentary life, it was his custom, when the weather would admit, to walk in his garden; or otherwise in some room of his house, by way of exercise. By this method, united with the strictest temperance in eating, and an equal abstemiousness in drinking, he enjoyed a good state of health, though his constitution was delicate. His domestic manner of living did not preclude him from a very extensive and honourable acquaintance. His house, especially on a Sunday evening, was the resort of the most distinguished persons of all ranks, an particularly of such as had rendered themselves eminent by their knowledge or love of literature. He received foreigners, who were fond of learning, with an affability and kindness which excited in them the highest respect and veneration; and his instructive and cheerful conversation made him the delight of his friends in general. He was during the latter part of his life, agent for the province of Georgia in North America; and died at the close of the year 1775, in the 67th year of his age. The doctor's literary knowledge was by no means confined to the subjects on which he more particularly treated as an author; he was well acquainted with the mathematics, and had read much in medicine. It hath been with great reason believed, that if he had dedicated his studies to the last science, he would have made a very conspicuous figure in the physical profession. He was eminently versed in the different parts of sacred literature; and his acquaintance with the languages extended not only to the Hebrew, Greek, and Latin among the ancient, and to the French, Italian, Spanish, Portuguese, and Dutch, among the modern; but likewise to the Oriental tongues. He was particularly fond of the Greek language. His attainment of such a variety of knowledge was exceedingly assisted by a memory surprisingly retentive, and which indeed astonished every person with whom he was conversant. In communicating his ideas, he had an uncommon readiness and facility; and the style of his works, which had been formed upon the model of that of the celebrated bishop Sprat, was perspicuous, easy, flowing, and harmonious. To all these accomplishments of the understanding, Dr Campbell joined the more important virtues of a moral and pious character. His disposition was gentle and humane, and his manners kind and obliging. He was the tenderest of husbands, a most indulgent parent, a kind master, a firm and sincere friend. To his great Creator he paid the constant and ardent tribute of devotion, duty, and reverence; and in his correspondences he showed that a sense of piety was always nearest his heart.

CAMPBELLTOWN, a parliament town of Argyle-shire in Scotland, seated on the lough of Kilkerran, on the eastern shore of Kintyre or Cantyre, of which it is the capital. It hath a good harbour; and is now a very considerable place, though within these 50 years only a petty fishing town. It has in fact been created by the fishery: for it was appointed the place

place of rendezvous for the busses; and above 260 have been seen in the harbour at once. The inhabitants are reckoned to be upwards of 8000 in number. W. Long. 5. 10. N. Lat. 54.

CAMPDEN, a small town of Gloucestershire in England, containing about 200 houses. It gives title of Viscount, by courtesy, to Earl of Gainsborough his son. W. Long. 1. 50. N. Lat. 52.

CAMPEACHY, a town of Mexico in South America, seated on the east coast of a bay of the same name, on the west of the province of Yucataro. It is defended by a good wall and strong forts; but is neither so rich, nor carries on such a trade, as formerly; it having been the port for the sale of logwood, the place where it is cut being about 30 miles distant. It was taken by the English in 1596; by the bucaneers in 1673; and by the Flibusters of St Domingo in 1685, who set it on fire and blew up the citadel. W. Long. 93. 7. N. Lat. 19. 20.

*Campeachy-Wood*, in botany. See Hæmatoxylum.

CAMPEN, a strong town of Overyssel in the United Provinces. It hath a citadel and a harbour; but the latter is almost choked up with sand. It was taken by the Dutch in 1578, and by the French in 1672; but they abandoned it the following year. It is seated near the mouth of the river Yssel and Zuider See. E. Long. 5. 35. N. Lat. 52. 38.

CAMPESTRE, in antiquity, a sort of cover for the privities, worn by the Roman soldiers in the field exercises; being girt under the navel, and hanging down to the knees. The name is supposed to be formed from *campus*, the field or place where the Roman soldiers performed their exercises.

CAMPHORA, or Camphire, a solid concrete juice extracted from the wood of the laurus comphora. See Laurus, Chemistry, and Materia Medica.

Pure camphire is very white, pellucid, somewhat unctuous to the touch; of a bitterish aromatic taste, yet accompanied with a sense of coolness; of a very fragrant smell, somewhat like that of rosemary, but much stronger. It has been very long esteemed one of the most efficacious diaphoretics; and has been celebrated in fevers, malignant and epidemical distempers. In deliria, also, where opiates could not procure sleep, but rather aggravated the symptoms, this medicine has often been observed to procure it. All these effects, however, Dr Cullen attributes to its sedative property, and denies that camphire has any other medicinal virtues than those of an antispasmodic and sedative. He allows it to be very powerful, and capable of doing much good, or much harm. From experiments made on different brute creatures, camphire appears to be poisonous to every one of them. In some it produced sleep followed by death, without any other symptom. In others, before death, they were awakened into convulsions and rage. It seems, too, to act chiefly on the stomach; for an entire piece swallowed, produced the abovementioned effects with very little diminution of weight.

CAMPHUYSEN, (Dirk Theodore Raphael), an eminent painter, was born at Gorcum in 1586. He learned the art of painting from Diederic Govertze; and by a studious application to it, he very soon not only equalled, but far surpassed his master. He had an uncommon genius, and studied nature with care, judgement, and assiduity. His subjects were landscapes, mostly small, with ruinous buildings, huts of peasants, or views of villages on the banks of rivers, with boats and hoys, and generally he represented them by moonlight. His pencil is remarkably tender and soft, his colouring true nature and very transparent, and his expertness in perspective is seen in the proportional distances of his objects, which are excellently contrived, and have a surprising degree of nature and truth. As he left off painting at an age when others are scarcely qualified to commence artists, few of his works are to be met with, and they bring considerable prices; as they cannot but give pleasure to the eye of every observer. He painted his pictures with a thin body of colour, but they are handled with singular neatness and spirit. He practised in his profession only till he was 18 years of age, and being then recommended as a tutor to the sons of the lord of Nieuport, he undertook the employment, and discharged it with so much credit, that he was appointed secretary to that nobleman. He excelled in drawing with a pen; and the designs which he finished in that manner are exceedingly valued.



CAMPIAN (Edmond), an English Jesuit, was born at London, of indigent parents, in the year 1540; and educated at Christ's hospital, where he had the honour to speak an oration before queen Mary on her accession to the throne. He was admitted a scholar of St John's college in Oxford at its foundation, and took the degree of master of arts in 1564. About the same time he was ordained by a bishop of the church of England, and became an eloquent Protestant preacher. In 1566, when queen Elizabeth was entertained by the university of Oxford, he spoke an elegant oration before her majesty, and was also respondent in the philosophy act in St Mary's church. In 1568, he was junior proctor of the university. In the following year, he went over to Ireland, where he wrote a history of that kingdom, and turned papist; but being found rather too assiduous in persuading others to follow his example, he was committed to prison. He soon however, found means to make his escape. He landed in England in 1571; and thence proceeded to Doway in Flanders, where he publicly recanted his former heresy, and was created bachelor of divinity. He went soon after to Rome, where, in 1573, he was admitted of the society of Jesus, and was sent by the general of that order to Vienna, where he wrote his tragedy called *Nectar et ambrosia*, which was acted before the emperor with great applause.

From Vienna he went to Prague in Bohemia, where he resided in the Jesuits college about six years, and then returned to Rome. From thence, in 1580, he was sent by Pope Gregory XIII. with the celebrated Father Parsons, to convert the people of England. From Pitts we learn, that, some time before, several English priests, inspired by the Holy Ghost, had undertaken to convert their countrymen; that 80 of these foreign missionaries, besides several others, who by God's grace had been converted in England, were actually engaged in the pious work with great success; that some of them had suffered imprisonment, chains, tortures, and ignominious death, with becoming constancy and resolution: but seeing at last that the labour was abundant and the labourers few, they solicited the assistance of the



Jesuits;

Jesuits; requesting, that though not early in the morning, they would at least in the third, sixth, or ninth hour, send labourers into the Lord's vineyard. In consequence of this solicitation, the above two were sent to England. They arrived in an evil hour for Campian, at Dover; and were next day joyfully received by their friends at London. He had not been long in England, before Walsingham the secretary of state, being informed of his uncommon assiduity in the cause of the church of Rome, used every means in his power to have him apprehended, but for a long time without success. However, he was at last taken by one Elliot, a noted *priest-taker*, who found him in the house of Edward Yates, Esq; at Lyford in Berkshire, and conducted him in triumph to London, with a paper on his hat, on which was written *Campian the Jesuit*. He was imprisoned in the tower; where, Wood says, "he did undergo many examinations, abuses, wrackings, tortures;" *exquisitissimis cruciatibus tortus*, says Pitts. It is hoped, for the credit of the reformers, this torturing part of the story is not true. The poor wretch, however, was condemned, on the statute 25 Ed. III. for high treason; and butchered at Tyburn, with two or three of his fraternity. Howsoever criminal in the eye of the law, or of the English gospel, might be the zeal of this Jesuit for the salvation of the poor heretics of that kingdom, biographers of each persuasion unite in giving him a great and amiable character. "All writers (says the Oxford antiquary), whether Protestants or Popish, say, that he was a man of admirable parts; an elegant orator, a subtile philosopher and disputant, and an exact preacher whether in English or the Latin tongue, of a sweet disposition, and a well-polished man." Fuller, in his church-history, says, "he was of a sweet nature, constantly carrying about him the charms of a plausible behaviour, of a fluent tongue, and good parts." His History of Ireland, in two books, was written in 1570; and published, by Sir James Ware, from a manuscript in the Cotton library, Dublin, 1633, folio. He wrote also *Chronologia universalis*, a very learned work; and various other tracts.

CAMPICURSIO, in the ancient military art, a march of armed men for several miles, from and back again to the camp, to instruct them in the military pace. This exercise was nearly akin to the *decursio*, from which it only differed, in that the latter was performed by horsemen, the former also by foot.

CAMPIDOCTORES, or CAMPIDUCTORES, in the Roman army, were officers who instructed the soldiery in the discipline and exercises of war, and the art of handling their weapons to advantage. These are also sometimes called *campigeni*, and *armidoctores*.

CAMPIDUCTOR, in middle-age writers, signifies the leader or commander of an army, or party.

CAMPION, in botany, the English name of the LYCHNIS.

CAMPION, a town of the kingdom of Tanguth in Tartary. It was formerly remarkable for being a place through which the caravans passed in the road from Bukharia to China. E. Long. 104. 53. N. Lat. 40. 25.

CAMPISTRON, a celebrated French dramatic author, was born in 1656. Racine directed his poetical talents to the theatre, and assisted him in his first pieces. He died in 1723.



CAMPITÆ, in church history, an appellation given to the donatists, on account of their assembling in the field, for want of churches. For a similar reason, they were also denominated *Montenses* and *Rupitani*.

CAMPLI, or CAMPOLI, a town of Italy, in the kingdom of Naples, and in the farther Abruzzo, situated in E. Long. 13. 55. N. Lat. 42. 38.

CAMPO MAJOR, a town of the province of Alentejo in Portugal. W. Long. 7. 24. N. Lat. 38. 50.

CAMPREDON, a town of Catalonia in Spain, seated at the foot of the Pyrenean mountains. The fortifications were demolished by the French in 1691. W. Long. 1. 56. N. Lat. 42. 20.

CAMPS (Francis de), abbot of Notre Dame at Sigi, was born at Amiens in 1643; and distinguished himself by his knowledge of medals, by writing an history of France, and several other works. He died at Paris in 1723.

CAMPVERE. See VEER.

CAMPUS, in antiquity, a field or vacant plain in a city, not built upon, left vacant on account of shows, combats, exercises, or other uses of the citizens.

*CAMPUS Maii*, in ancient customs, an anniversary assembly of the ancient Britons held on May-day, when they confederated together for the defence of the kingdom against all its enemies.

*CAMPUS Martius*, a large plain in the suburbs of ancient Rome, lying between the Quirinal and Capitoline mounts and the Tiber, thus called because consecrated to the god Mars, and set apart for military sports and exercises to which the Roman youth were trained, as the use and handling of arms, and all manner of feats of activity. Here were the races run, either with chariots or single horses; here also stood the villa publica, or palace for the reception of ambassadors, who were not permitted to enter the city. Many of the public comitia were held in the same field, part of which was for that purpose cantoned out. The place was also nobly decorated with statues, arches, columns, porticoes, and the like structures.

*CAMPUS Sceleratus*, a place without the walls of ancient Rome, where the Vestals who had violated their vows of virginity were buried alive.

CAMUL, a town of Asia, on the eastern extremity of the kingdom of Cialus, on the frontiers of Tangut. E. Long. 98. 5. N. Lat. 37. 15.

CAMUS, a person with a low flat nose, hollowed in the middle.

The Tartars are great admirers of camus beauties. Rubruquis observes, that the wife of the great Jenghiz Khan, a celebrated beauty, had only two holes for a nose.

CAMUS (John Peter), a French prelate born in 1582. He was author of a number of pious romances (the taste of his time), and other theological works, to the amount of 200 vols. His definition of politics is remarkable: *Ars non tam regendi, quam fallendi, homines;* "the art not so much of governing, as of deceiving mankind." He died in 1652.

CAN, in the sea-language, as can-pump, a vessel wherewith seamen pour water into the pump to make it go.

*CAN-Buoy*. See BOUY.

*CAN-Hook*, an instrument used to sling a cask by the ends of the staves: it is formed by fixing a broad and flat

flat hook at each end of a short rope; and the tackle by which the cask so slung may be hoisted or lowered, is hooked to the middle of the rope.

CANA, (anc. geog.) a town on the confines of the Upper and Lower Galilee: memorable for the turning water into wine (John). The birth place of Simeon, called *Cananite* from this place, and of Nathaniel.

CANAAN, the fourth son of Ham. The irreverence of Ham towards his father Noah is recorded in Gen. ix. Upon that occasion the patriarch cursed him in a branch of his posterity: "Cursed," says he, "be Canaan; a servant of servants shall he be unto "his brethren." This curse being pronounced, not against Ham the immediate transgressor, but against his son, who does not appear, from the words of Moses, to have been any ways concerned in the crime, hath occasioned several conjectures. Some have believed that Noah cursed Canaan, because he could not well have cursed Ham himself, whom God had not long before blessed. Others think Moses's chief intent in recording this prediction was to raise the spirits of the Israelites, then entering on a terrible war with the children of Canaan, by the assurance, that, in consequence of the curse, that people were destined by God to be subdued by them. For the opinion of those who imagine all Ham's race were here accursed, seems repugnant to the plain words of Scripture, which confines the malediction to Canaan and his posterity; and is also contrary to fact. Indeed, the prophecy of Noah, that Canaan "should be a servant of servants to his brethren," seems to have been wholly completed in him. It was completed with regard to Shem, not only in that a considerable part of the seven nations of the Canaanites were made slaves to the Israelites, when they took possession of their land, as part of the remainder of them were afterwards enslaved by Solomon; but also by the subsequent expeditions of the Assyrians and Persians, who were both descended from Shem; and under whom the Canaanites suffered subjection, as well as the Israelites; not to mention the conquest of part of Canaan by the Elamites, or Persians, under Chedorlaomer, prior to them all. With regard to Japhet, we find a completion of the prophecy, in the successive conquests of the Greeks and Romans in Palestine and Phœnicia, where the Canaanites were settled; but especially in the total subversion of the Carthaginian power by the Romans; besides some invasions of the northern nations, as the posterity of Thogarma and Magog; wherein many of them, probably, were carried away captive.

The posterity of Canaan were very numerous. His eldest son was Sidon, who at least founded and peopled the city of Sidon, and was the father of the Sidonians and Phœnicians. Canaan had besides ten sons, who were the fathers of so many people, dwelling in Palestine, and in part of Syria; namely, the Hittites, the Jebusites, the Amorites, the Girgasites, the Hivites, the Arkites, the Sinites, the Arvadites, the Zemarites, and Hamathites.

*Land of* CANAAN, the country so named from Canaan the son of Ham. It lies between the Mediterranean sea and the mountains of Arabia, and extends from Egypt to Phœnicia. It is bounded to the east by the mountains of Arabia; to the south by the wilderness of Paran, Idumæa, and Egypt; to the west by the Mediterranean, called in Hebrew the Great Sea; to the north by the mountains of Libanus. Its length from the city of Dan (since called Cæsarea Philippi, or Paneadis, which stands at the foot of these mountains) to Beersheba, is about 70 leagues; and its breadth from the Mediterranean sea to the eastern borders, is in some places 30. This country, which was first called Canaan, from Canaan the son of Ham, whose posterity possessed it, was afterwards called Palestine, from the people which the Hebrews call Philistines, and the Greeks and Romans corruptly Palestines, who inhabited the sea coasts, and were first known to them. It likewise had the name of the *Land of Promise*, from the promise God made Abraham of giving it to him; that of the *Land of Israel*, from the Israelites having made themselves masters of it; that of *Judah*, from the tribe of Judah, which was the most considerable of the twelve: and lastly, the happiness it had of being sanctified by the presence, actions, miracles, and death of Jesus Christ, has given it the name of the *Holy Land*, which it retains to this day.



The first inhabitants of this land therefore were the Canaanites, who were descended from Canaan, and the eleven sons of that patriarch. Here they multiplied extremely; trade and war were their first occupations; these gave rise to their riches, and the several colonies scattered by them over almost all the islands and maritime provinces of the Mediterranean. The measure of their idolatry and abominations was completed, when God delivered their country into the hands of the Israelites. In St Athanasius's time, the Africans still said they were descended from the Canaanites; and it is said, that the Punic tongue was almost entirely the same with the Canaanitish and Hebrew language. The colonies which Cadmus carried into Thebes in Bœotia, and his brother Cilix into Cilicia, came from the stock of Canaan. The isles of Sicily, Sardinia, Malta, Cyprus, Corfu, Majorca and Minorca, Gades and Ebusus, are thought to have been peopled by the Canaanites. Bochart, in his large work entitled *Canaan*, has set all this matter in a good light.

Many of the old inhabitants of the north-west of the land of Canaan, however, particularly on the coast or territories of Tyre and Sidon, were not driven out by the children of Israel, whence this tract seems to have retained the name of Canaan a great while after those other parts of the country, which were better inhabited by the Israelites, had lost the said name. The Greeks called this tract inhabited by the old Canaanites along the Mediterranean sea, Phœnicia; the more inland parts, as being inhabited partly by Canaanites, and partly by Syrians, Syrophœnicia: and hence the woman said by St Matthew (xv. 22.) to be a woman of Canaan, whose daughter Jesus cured, is said by St Mark (vii. 26.) to be a Syrophœnician by nation, as she was a Greek by religion and language.

CANADA, or the province of Quebec, an extensive country of North America, bounded on the north-east by the gulph of St Lawrence, and St John's river; on the south-west, by lands inhabited by the savage Indians, which are frequently included in this province; on the south, by the province of Nova-Scotia, the states of New-England, and New-York; and on the north-weſt, by other Indian nations. Under the name of *Canada*, the French comprehended a very large territory; taking into their claim part of New-Scotland, New-England, and New-York on the eaſt; and extending it on the weſt as far as the Pacific Ocean. That part, however, which was reduced by the Britiſh arms in the laſt war, lies between 61 and 81 degrees of weſt longitude, and between 45 and 52 of north latitude. The climate is not very different from that of the northern Britiſh colonies; but as it is much further from the ſea, and more to the northward, than moſt of thoſe provinces, it has a much ſeverer winter, though the air is generally clear; and, like moſt of thoſe American tracts that do not lie too far to the northward, the ſummers are very hot, and exceeding pleaſant. The ſoil in general is very good, and in many parts extremely fertile; producing many different ſorts of grains, fruits, and vegetables. The meadow grounds, which are well watered, yield excellent graſs, and breed vaſt numbers of great and ſmall cattle. The uncultivated parts are a continued wood, compoſed of prodigiouſly large and lofty trees, of which there is ſuch a variety of ſpecies, that even of thoſe who have taken moſt pains to know them, there is not perhaps one that can tell half the number. Canada produces, among others, two ſorts of pines, the white and the red; four ſorts of firs; two ſorts of cedar and oak, the white and the red; the male and female maple; three ſorts of aſh-trees, the free, the mungrel, and the baſtard; three ſorts of walnut-trees, the hard, the ſoft, and the ſmooth; vaſt numbers of beech-trees and white wood; white and red elms, and poplars. The Indians hollow the red elms into canoes, ſome of which made out of one piece will contain 20 perſons; others are made of the bark; the different pieces of which they ſew together with the inner rind, and daub over the ſeams with pitch, or rather a bituminous matter reſembling pitch, to prevent their leaking; the ribs of theſe canoes are made of boughs of trees. In the hollow elms, the bears and wild cats take up their lodgings from November to April. The country produces alſo a vaſt variety of other vegetables, particularly tobacco, which thrives well. Near Quebec is a fine lead mine, and many excellent ones of iron have been diſcovered. It hath alſo been reported that ſilver is found in ſome of the mountains. The rivers are extremely numerous, and many of them very large and deep. The principal are, the Ouattauais, St John's, Seguinay, Deſpaires, and Trois Rivieres; but all theſe are ſwallowed up by the great river St Laurence. This river iſſues from the lake Ontario; and, taking its courſe north-eaſt, waſhes Montreal, where it receives the Ouattauais, and forms many fertile iſlands. It continues the ſame courſe, and meets the tide upwards of 400 miles from the ſea, where it is navigable for large veſſels; and below Quebec, 320 miles from the ſea, it becomes ſo broad and ſo deep, that ſhips of the line contributed in the laſt war to reduce that city. After receiving in its progreſs innumerable ſtreams, it at laſt falls into the ocean at cape Roſiers, where it is 90 miles broad, and where the cold is intenſe and the ſea boiſterous. This river is the only one upon which any ſettlements of note are as yet formed; but it is very probable, that, in time to come, Canada, and thoſe vaſt regions to the weſt, may be enabled of themſelves to carry on a conſiderable trade upon the great lakes of freſh water which theſe countries environ. Here are five lakes, the leaſt of which is of greater extent than the freſh-water lakes to be found in any other part of the world: theſe are the lake Ontario, which is no leſs than 200 leagues in circumference; Erie, or Oſwego, longer, but not ſo broad, is about the ſame extent. That of the Huron ſpreads greatly in width, and is about 300 leagues in circuit: as alſo is that of Machigan, though like lake Erie it is rather long, and comparatively narrow. But the lake Superior is larger than any of theſe, being no leſs than 500 leagues in circumference. All theſe are navigable by any veſſels, and they all communicate with each other; but the paſſage between Erie and Ontario is interrupted by a moſt ſtupendous fall or cataract, called the *falls of Niagara**. The river St Lawrence, as already obſerved, is the outlet of theſe lakes, by which they diſcharge themſelves into the ocean. The French built forts at theſe ſeveral ſtraits, by which the lakes communicate with one another, and on that where the laſt of them communicates with the river. By theſe, while the country was in their poſſeſſion, they effectually ſecured to themſelves the trade of the lakes, and preſerved an influence over all the Indian nations that lie near them.

* See *Niagara*.

The moſt curious and intereſting part of the natural hiſtory of Canada is the animals there produced. Theſe are ſtags, elks, deer, bears, foxes, martins, wild cats, ferrets, weaſels, large ſquirrels of a greyiſh hue, hares and rabbits. The ſouthern parts, in particular, breed great numbers of wild bulls, divers ſorts of roe bucks, goats, wolves, &c. The marſhes, lakes, and pools, with which this country abounds, ſwarm with otters and beavers, of which the white are highly valued, as well as the right black kind. A vaſt variety of birds are alſo to be found in the woods; and the river St Lawrence abounds with ſuch quantities of fiſh, that it is affirmed by ſome writers, this would be a more profitable article that even the fur-trade.—There are in Canada a multitude of different Indian tribes; but theſe are obſerved to decreaſe in number where the Europeans are moſt numerous; owing chiefly to the immoderate uſe of ſpirituous liquors, of which they are exceſſively fond. Their manners and way of living we have already particularly deſcribed†. The principal towns are Quebec, Trois Rivieres, and Montreal. The commodities required by the Canadians from Europe are, wine, or rather rum; cloths, chiefly coarſe; linen; and wrought iron. The Indian trade requires rum, tobacco, a ſort of duffil blankets, guns, powder, balls, and flints, kettles, hatchets, toys, and trinkets of all kinds. While the country was in poſſeſſion of the French, the Indians ſupplied them with poultry; and the French had traders, who like the original inhabitants, traverſed the vaſt lakes and rivers in canoes, with incredible induſtry and patience, carrying their goods into the remoteſt parts of America, and among nations entirely unknown to us. Theſe again brought the furs, &c. home to them, as the Indians were thereby habituated to trade with them. For this purpoſe, people from all parts, even from the diſtance of 1000 miles, came to the French fair at Montreal, which began in June, and ſometimes laſted three months. On this occaſion many ſolemnities were obſerved, guards were

† See *America*, Nº 9.—80.

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were placed, and the governor aſſiſted to preſerve order in ſo great and various a concourſe of ſavage nations. But ſometimes great diſorders and tumults happened; and the Indians frequently gave for a dram all that they were poſſeſſed of. It is remarkable, that many of theſe nations actually paſſed by the Engliſh ſettlement of Albany in New-York, and travelled 200 miles further to Montreal, though they could have purchaſed the goods they wanted cheaper at the former.

Since Britain became poſſeſſed of Canada, their trade with that country has generally employed 34 ſhips and 400 ſeamen; their exports, at an average of three years, in ſkins, furs, ginſeng, ſnake-root, capillaire, and wheat, amount to 150,000*l.* Their imports from Great Britain are computed at nearly the ſame ſum. It will, however, be always impoſſible to overcome certain inconveniences ariſing from the violence of the winter. This is ſo exceſſive from December to April, that the broadeſt rivers are frozen over, and the ſnow lies commonly from four to ſix feet deep on the ground, even in thoſe parts of the country which lie three degrees ſouth of London, and in the temperate latitude of Paris. Another inconvenience ariſes from the falls in the river St Lawrence below Montreal, which prevent ſhips from penetrating to that emporium of inland commerce. The communication therefore with Canada, and the immenſe regions beyond it, will always be interrupted during the winter-ſeaſon, until roads are formed that can be travelled without danger from the Indians. For theſe ſavage people often commit hoſtilities without any previous notice; and frequently, without any provocation, they commit the moſt horrid ravages for a long time with impunity.

Canada was undoubtedly diſcovered by Sebaſtian Cabot, the famous Italian adventurer, who ſailed under a commiſſion from Henry VII. But though the Engliſh monarch did not think proper to make any uſe of this diſcovery, the French quickly attempted it; we have an account of their fiſhing for cod on the banks of Newfoundland, and along the ſea-coaſt of Canada, in the beginning of the 16th century. About the year 1506, one Denys, a Frenchman, drew a map of the gulph of St. Lawrence; and two years after, one Aubort, a ſhip maſter of Dieppe, carried over to France ſome of the natives of Canada. As the new country, however, did not promiſe the ſame amazing quantities of gold and ſilver produced by Mexico and Peru, the French for ſome years neglected the diſcovery. At laſt, in the year 1523, Francis I. a ſenſible and enterpriſing prince, ſent four ſhips, under the command of Verazani, a Florentine, to proſecute diſcoveries in that country. The particulars of this man's firſt expedition are not known. All we can learn is, that he returned to France, and next year he undertook a ſecond. As he approached the coaſt, he met with a violent ſtorm; however, he came ſo near as to perceive the natives on the ſhore, making friendly ſigns to him to land. This being found impracticable by reaſon of the ſurf upon the coaſt, one of the ſailors threw himſelf into the ſea; but, endeavouring to ſwim back to the ſhip, a ſurge thew him on ſhore without ſigns of life. He was, however, treated by the natives with ſuch care and humanity, that he recovered his ſtrength, and was allowed to ſwim back to the ſhip, which immediately returned to France. This is all we know of Verazani's ſecond expedition. He undertook a third, but was no more heard of, and it is thought that he and all his company periſhed before he could form any colony. In 1534, one Jaques Cartier of St Maloes ſet ſail under a commiſſion from the French king, and on the 10th of May arrived at Cape Bonaviſta in Newfoundland. He had with him two ſmall ſhips beſides the one in which he ſailed. He cruiſed along the coaſts of that iſland, on which he diſcovered inhabitants, probably the Eſkimaux. He landed in ſeveral places along the coaſt of the Gulf, and took poſſeſſion of the country in the king's name. On his return, he was again ſent out with a commiſſion, and a pretty large force: he returned in 1535, and paſſed the winter at St Croix; but the ſeaſon proved ſo ſevere, that he and his companions muſt have died of the ſcurvy, had they not, by the advice of the natives, made uſe of the decoction of the tops and bark of the white pines. As Cartier, however, could produce neither gold nor ſilver, all that he could ſay about the utility of the ſettlement was diſregarded; and in 1540, he was obliged to become pilot to one M. Roberval, who was by the French king appointed viceroy of Canada, and who ſailed from France with five veſſels. Arriving at the gulph of St Lawrence, they built a fort; and Cartier was left to command the garriſon in it, while Roberval returned to France for additional recruits to his new ſettlement. At laſt, having embarked in 1549, with a great number of adventurers, neither he nor any of his followers were heard of more.

This fatal accident ſo greatly diſcouraged the court of France, that, for 50 years, no meaſures were taken for ſupplying with neceſſaries the ſettlers that were left. At laſt, Henry IV. appointed the Marquis de la Roche lieutenant-general of Canada and the neighbouring countries. In 1598 he landed on the iſle of Sable, which he abſurdly thought to be a proper place for a ſettlement, though it was without any port, and without product except briars. Here he left about 40 malefactors, the refuſe of the French jails. After cruizing for ſome time on the coaſt of Nova Scotia, without being able to relieve theſe poor wretches, he returned to France, where he died of a broken heart. His colony muſt have periſhed, had not a French ſhip been wrecked on the iſland, and a few ſheep driven upon it at the ſame time. With the boards of the ſhip they erected huts; and while the ſheep laſted they lived on them, feeding afterwards on fiſh. Their clothes wearing out, they made coats of ſeal-ſkins; and in this miſerable condition they ſpent ſeven years, when Henry ordered them to be brought to France. The king had the curioſity to ſee them in their ſeal-ſkin dreſſes, and was ſo moved with their appearance, that he forgave them all their offences, and gave each of them 50 crowns to begin the world anew.

In 1600, one Chauvin, a commander in the French navy, attended by a merchant of St Malo, called *Pontgrave*, made a voyage to Canada, from whence he returned with a very profitable quantity of furs. Next year he repeated the voyage with the ſame good fortune, but died while he was preparing for a third. The many ſpecimens of profit to be made by the Canadian trade, at laſt induced the public to think favourably of it. An armanent was equipped, and the command of it given to Pontgrave, with powers to extend his diſcoveries

veries up the river St Lawrence. He ſailed in 1603, having in his company Samuel Champlain, who had been a captain in the navy, and was a man of parts and ſpirit. It was not, however, till the year 1608, that the colony was fully eſtabliſhed. This was accompliſhed by founding the city of Quebec, which from that time commenced the capital of all the ſettlements in Canada. The colony, however, for many years continued in a low way, and was often in danger of being totally exterminated by the Indians. As the particulars of theſe wars, however, could neither he entertaining, nor indeed intelligible, to many of our readers, we chooſe to omit them, and in general obſerve, that the French not only concluded a permanent peace with the Indians, but ſo much ingratiated themſelves with them, that they could with the greateſt eaſe prevail upon them at any time to murder and ſcalp the Engliſh in their ſettlements. Theſe practices had a conſiderable ſhare in bringing about the war with France, when the whole country was conquered by the Britiſh in 1761. The moſt remarkable tranſaction in this conqueſt was the ſiege of QUEBEC; for a particular account of which, ſee that article. And for the tranſactions here during the late American war, ſee AMERICA (United States of), nº 195, 200—207.

CANAL *of* COMMUNICATION, an artificial cut in the ground, ſupplied with water from rivers, ſprings, &c. in order to make a navigable communication betwixt one place and another.

The particular operations neceſſary for making artificial navigations depend upon a number of circumſtances. The ſituation of the ground; the vicinity or connection with rivers; the eaſe or difficulty with which a proper quantity of water can be obtained; theſe and many other circumſtances neceſſarily produce great variety in the ſtructure of artificial navigations, and augment or diminiſh the labour and expence of executing them. When the ground is naturally level, and unconnected with rivers, the execution is eaſy, and the navigation is not liable to be diſturbed by floods; but, when the ground riſes and falls, and cannot be reduced to a level, artificial methods of raiſing and lowering veſſels muſt be employed; which likewiſe vary according to circumſtances.

A kind of temporary ſluices are ſometimes employed for raiſing boats over falls or ſhoals in rivers by a very ſimple operation. Two poſts or pillars of maſon-work, with grooves, are fixed, one on each bank of the river, at ſome diſtance below the ſhoal. The boat having paſſed theſe poſts, planks are let down acroſs the river by pullies into the grooves, by which the water is dammed up to a proper height for allowing the boat to paſs up the river over the ſhoal.

The Dutch and Flemings at this day ſometimes, when obſtructed by caſcades, form an inclined plane or rolling-bridge upon dry land, alongſt which their veſſels are drawn from the river below the caſcade into the river above it. This, it is ſaid, was the only method employed by the ancients, and is ſtill uſed by the Chineſe, who are ſaid to be entirely ignorant of the nature and utility of locks. Theſe rolling-bridges conſiſt of a number of cylindrical rollers which turn eaſily on pivots, and a mill is commonly built near by, ſo that the ſame machinery may ſerve the double purpoſe of working the mill and drawing up veſſels.

A LOCK is a baſon placed lengthwiſe in a river or canal, lined with walls of maſonry on each ſide, and terminated by two gates, placed where there is a caſcade or natural fall of the country; and ſo conſtructed, that the baſon being filled with water by an upper ſluice to the level of the waters above, a veſſel may aſcend thro' the upper gate; or the water in the lock being reduced to the level of the water at the bottom of the caſcade, the veſſel may deſcend through the lower gate; for when the waters are brought to a level on either ſide, the gate on that ſide may be eaſily opened. But as the lower gate is ſtrained in proportion to the depth of water it ſupports, when the perpendicular height of the water exceeds 12 or 13 feet, more locks than one become neceſſary. Thus, if the fall be 17 feet, two locks are required, each having 8½ feet fall; and if the fall be 26 feet, three locks are neceſſary, each having 8 feet 8 inches fall. The ſide-walls of a lock ought to be very ſtrong. Where the natural foundation is bad, they ſhould be founded on piles and platforms of wood: they ſhould likewiſe ſlope outwards, in order to reſiſt the preſſure of the earth from behind.

Plate CXIV. fig. 1. A perſpective view of part of a canal: the veſſel L, within the lock AC.—Fig. 2. Section of an open lock; the veſſel L about to enter.—Fig. 3. Section of a lock full of water; the veſſel L raiſed to a level with the water in the ſuperior canal.—Fig. 4. Ground ſection of a lock. L, a veſſel in the inferior canal. C, the under gate. A, the upper gate. G H, a ſubterraneous paſſage for letting water from the ſuperior canal run into the lock. KF, a ſubterraneous paſſage for water from the lock to the inferior canal.

X and Y (fig. 1.) are the two flood-gates, each of which conſiſts of two leaves, reſting upon one another, ſo as to form an obtuſe angle, in order the better to reſiſt the preſſure of the water. The firſt (X) prevents the water of the ſuperior canal from falling into the lock; and the ſecond (Y) dams up and ſuſtains the water in the lock. Theſe flood-gates ought to be very ſtrong, and to turn freely upon their hinges. In order to make them open and ſhut with eaſe, each leaf is furniſhed with a long lever A *b*, A *b*; C *b*, C *b*. They ſhould be made very tight and cloſe, that as little water as poſſible may be loſt.

By the ſubterraneous paſſage G H (fig. 2, 3, & 4) which deſcends obliquely, by opening the ſluice G, the water is let down from the ſuperior canal D into the lock, where it is ſtopt and retained by the gate C when ſhut, till the water on the lock comes to be on a level with the water in the ſuperior canal D; as repreſented, fig. 3. When, on the other hand, the water contained by the lock is to be let out, the paſſage G H muſt be ſhut by letting down the ſluice G, the gate A muſt be alſo ſhut, and the paſſage K F opened by raiſing the ſluice K: a free paſſage being thus given to the water, it deſcends through K F, into the inferior canal, until the water in the lock is on a level with the water in the inferior canal B; as repreſented, fig. 2.

Now, let be required to raiſe the veſſel L (fig. 2) from the inferior canal B to the ſuperior one D; if the lock happens to be full of water, the ſluice G muſt be ſhut, and alſo the gate A, and the ſluice K opened, ſo

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ſo that the water in the lock may run out till it is on a level with the water in the inferior canal B. When the water in the lock comes to be on a level with the water at B, the leaves of the gate C are opened by the levers C *b*, which is eaſily performed, the water on each ſide of the gate being in equilibrio; the veſſel then ſails into the lock. After this the gate C and the ſluice K are ſhut, and the ſluice G opened, in order to fill the lock, till the water in the lock, and conſequently the veſſel, be upon a level with the water in the ſuperior canal D; as is repreſented in fig. 3. The gate A is then opened, and the veſſel paſſes into the canal D.

Again, let it be required to make a veſſel deſcend from the canal D into the inferior canal B. If the lock is empty, as in fig. 2. the gate C and ſluice K muſt be ſhut, and the upper ſluice G opened, ſo that the water in the lock may riſe to a level with the water in the upper canal D. Then open the gate A, and let the veſſel paſs thro' into the lock. Shut the gate A and the ſluice G; then open the ſluice K, till the water in the lock be on a level with the water in the inferior canal; then the gate C is opened, and the veſſel paſſes along into the canal B, as was required.

It is almoſt needleſs to ſpend time in enumerating the many advantages which neceſſarily reſult from artificial navigations. Their utility is now ſo apparent, that moſt nations in Europe give the higheſt encouragement to undertakings of this kind wherever they are practicable. The advantages of navigable canals did not eſcape the obſervation of the ancients. From the moſt early accounts of ſociety we read of attempts to cut through large iſthmuſes, in order to make a communication by water, either betwixt different nations, or diſtant parts of the ſame nation, where land-carriage was long and expenſive. Herodotus relates, that the Cnidians, a people of Caria in Aſia Minor, deſigned to cut the iſthmus which joins that peninſula to the continent; but were ſuperſtitious enough to give up the undertaking, becauſe they were interdicted by an oracle. Several kings of Egypt attempted to join the Red-Sea to the Mediterranean Cleopatra was exceedingly fond of this project. Soliman II. emperor of the Turks, employed 50,000 men in this great work. This canal was completed under the caliphate of Omar, but afterwards allowed to fall into diſrepair; ſo that it is now difficult to diſcover any traces of it. Both the Greeks and Romans intended to make a canal acroſs the Iſthmus of Corinth, which joins the Morea and Achaia, in order to make a navigable paſſage by the Ionian ſea into the Archipelago. Demetrius, Julius Cæſar, Caligula, and Nero, made ſeveral unſucceſsful efforts to open this paſſage. But, as the ancients were entirely ignorant of the uſe of water-locks, their whole attention was employed in making level cuts, which is probably the principal reaſon why they ſo often failed in their attempts. Charlemagne formed a deſign of joining the Rhine and the Danube, in order to make a communication between the ocean and the Black Sea, by a canal from the river Almutz which diſcharges itſelf into the Danube, to the Reditz, which falls into the Maine, and this laſt falls into the Rhine near Mayence: for this purpoſe he employed a prodigious number of workmen; but he met with ſo many obſtacles from different quarters, that he was obliged to give up the attempt.

The French at preſent have many fine canals: that of Briare was begun under Henry IV. and finiſhed under the direction of cardinal Richlieu in the reign of Louis XIII. This canal makes a communication betwixt the Loire and the Seine by the river Loing. It extends 11 French great leagues from Briare to Montargis. It enters the Loire a little above Briare, and terminates in the Loing at Cepoi. There are 42 locks on this canal.

The canal of Orleans, for making another communication between the Seine and the Loire, was begun in 1675, and finiſhed by Philip of Orleans, regent of France, during the minority of Louis XV. and is furniſhed with 20 locks. It goes by the name of the *canal of Orleans;* but it begins at the village of Kombleux, which is a ſhort French league from the town of Orleans.

But the greateſt and moſt uſeful work of this kind is the junction of the ocean with the Mediterranean by the canal of Languedoc. It was propoſed in the reigns of Francis I. and Henry IV. and was undertaken and finiſhed under Louis XIV. It begins with a large reſervoir 4000 paces in circumference, and 24 feet deep, which receives many ſprings from the mountain Noire. This canal is about 64 leagues in length, is ſupplied by a number of rivulets, and is furniſhed with 104 locks, of about eight feet riſe each. In ſome places it paſſes over bridges of vaſt height; and in others it cuts thro' ſolid rocks for 1000 paces. At one end it joins the river Garonne near Thouloufe, and terminates at the other in the lake Tau, which extends to the port of Cette. It was planned by Francis Riquet in 1666, and finiſhed before his death, which happened in 1680.

In the Dutch, Auſtrian, and French Netherlands, there is a very great number of canals; that from Bruges to Oſtend carries veſſels of 200 tons.

The Chineſe have alſo a great number of canals; that which runs from Canton to Pekin extends about 825 miles in length, and was executed about 800 years ago.

It would be an endleſs taſk to deſcribe the numberleſs canals in Holland, Ruſſia, Germany, &c. We ſhall therefore confine ourſelves to thoſe that are either already finiſhed, or at preſent executing, in Great-Britain.

As the promoting of commerce is the principal intention of making canals, it is natural to expect that their frequency in any nation ſhould bear ſome proportion to the trade carried on in it, providing the ſituation of the country will admit of them. The preſent ſtate of England and Scotland confirms this obſervation. Though the Romans made a canal between the Nyne, a little below Peterborough, and the Witham, three miles below Lincoln, which is now almoſt entirely filled up, yet it is not long ſince canals were revived in England. They are now however become very numerous, particularly in the counties of York, Lincoln, and Cheſhire. Moſt of the counties betwixt the mouth of the Thames and the Briſtol channel are connected together either by natural or artificial navigations; thoſe upon the Thames and Iſis reaching within about

20 miles of thoſe upon the Severn. The duke of Bridgewater's canal in Cheſhire runs 27 miles on a perfect level; but at Barton it is carried by a very high aqueduct bridge over the Irwell, a navigable river; ſo that it is common for veſſels to be paſſing at the ſame time both under and above the bridge. It is likewiſe cut ſome miles into the hills, where the Duke's coal-mines are wrought.

A navigable canal betwixt the Forth and Clyde in Scotland, and which divides the kingdom in two parts, was firſt thought of by Charles II. for tranſports and ſmall ſhips of war; the expence of which was to have been L. 500,000, a ſum far beyond the abilities of his reign. It was again projected in the year 1722, and a ſurvey made; but nothing more done till 1761, when the then Lord Napier, at his own expence, cauſed make a ſurvey, plan, and eſtimate on a ſmall ſcale. In 1764, the truſtees for fiſheries, &c. in Scotland cauſed make another ſurvey, plan, and eſtimate of a canal five feet deep, which was to coſt L. 79,000. In 1766, a ſubſcription was obtained by a number of the moſt reſpectable merchants in Glaſgow, for making a canal four feet deep and twenty-four feet in breadth; but when the bill was nearly obtained in Parliament, it was given up on account of the ſmallneſs of the ſcale, and a new ſubſcription ſet on foot for a canal ſeven feet deep, eſtimated at L. 150,000. This obtained the ſanction of Parliament; and the work was begun in 1768 by Mr Smeaton the engineer. The extreme length of the canal from the Forth to the Clyde is 35 miles, beginning at the mouth of the Carron, and ending at Dalmure Burnfoot on the Clyde, ſix miles below Glaſgow, riſing and falling 160 feet by means of 39 locks, 20 on the eaſt ſide of the ſummit, and 19 on the weſt, as the tide does not ebb ſo low in Clyde as in the Forth by nine feet. Veſſels drawing eight feet water, and not exceeding nineteen feet beam and ſeventy-three feet in length, paſs with eaſe, the canal having afterwards been deepened to upwards of eight feet. The whole enterpriſe diſplays the art of man in a high degree. The carrying the canal through moſs, quickſand, gravel, and rocks, up precipices and over valleys, was attended with inconceivable difficulties. There are eighteen draw-bridges and fifteen aqueduct bridges of note, beſides ſmall ones and tunnels. In the firſt three miles there are only ſix locks; but in the fourth mile there are no leſs than ten locks, and a very fine aqueduct bridge over the great road to the weſt of Falkirk. In the next ſix miles there are only four locks, which carry you to the ſummit. The canal then runs eighteen miles on a level, and terminates about a mile from Glaſgow. In this courſe, for a conſiderable way the ground is banked about twenty feet high, and the water is ſixteen feet deep, and two miles of it is made through a deep moſs. At Kirkintulloch, the canal is carried over the water of Logie on an aqueduct arch of ninety feet broad. This arch was thrown over in three ſtretches, having only a centre of thirty feet, which was ſhifted on ſmall rollers from one ſtretch to another; a thing new, and never attempted before with an arch of this ſize; yet the joinings are as fairly equal as any other part, and admired as a very fine piece of maſonry. On each ſide there is a very conſiderable banking over the valley. The work was carried on till it came within ſix miles of its junction with the Clyde; when the ſubſcription and a ſubſequent loan being exhauſted, the work was ſtopt in 1775. The city of Glaſgow, however, by means of a collateral branch, opened a communication with the Forth, which has prouduced a revenue of about L. 6000 annually; and, in order to finiſh the remaining ſix miles, the government in 1784 gave L. 50,000 out of the forfeited eſtates, the dividends ariſing from this ſum to be applied to making and repairing roads in the Highlands of Scotland. Accordingly the work has been reſumed; and by contract, under a high penalty, muſt be entirely completed in November 1789. The aqueduct bridge over the Kilven (now finiſhed, and ſuppoſed the greateſt of the kind in the world) conſiſts of four arches, and carries the canal over a valley 65 feet high and 420 in length, exhibiting a very ſingular effort of human ingenuity and labour. To ſupply the canal with water was of itſelf a very great work. There is one reſervoir of 50 acres 24 feet deep, and another of 70 acres 22 feet deep, into which many rivers and ſprings terminate, which it is thought will afford ſufficient ſupply of water at all times. This whole undertaking when finiſhed will coſt about L. 200,000. It is the greateſt of the kind in Britain, and without doubt will be of great national utility; though it is to be regretted that it had not been executed on a ſtill larger ſcale, the locks being too ſhort for tranſporting large maſts.

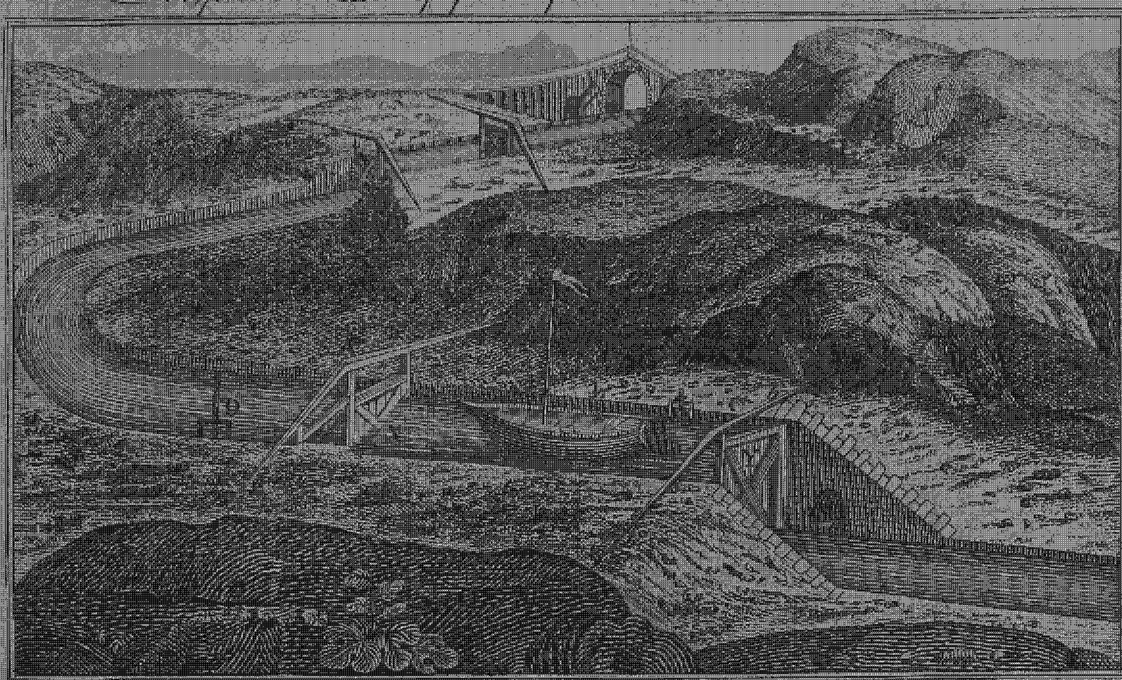
Canal, in anatomy, a duct or paſſage through which any of the juices flow.

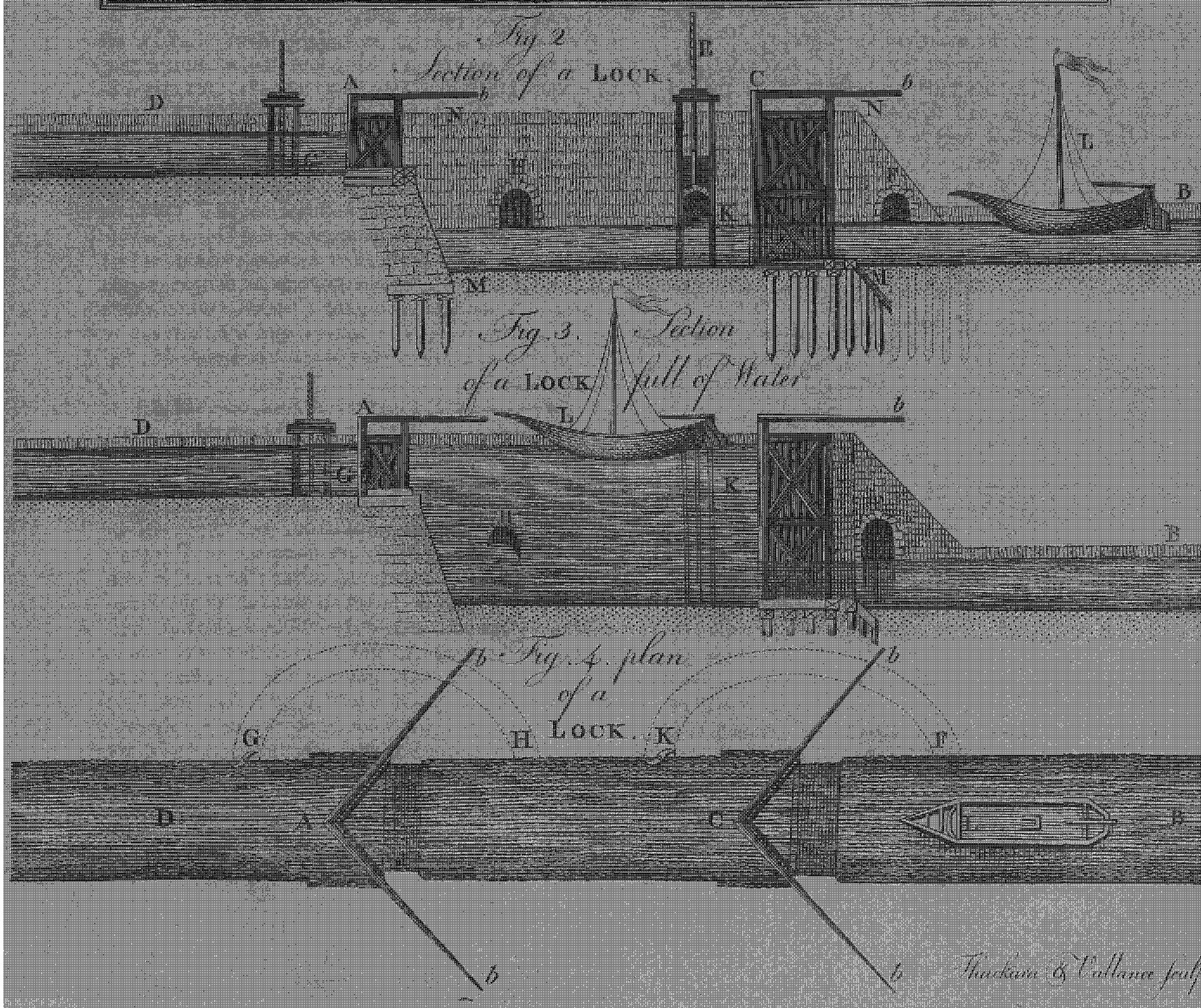
CANANOR, a large maritime town of Aſia, on the coaſt of Malabar, in a kingdom of the ſame name, with a very large and ſafe harbour. It formerly belonged to the Portugueſe, and had a ſtrong fort to guard it; but in 1683, the Dutch, together with the natives, drove them away; and after they became maſters of the town, enlarged the fortifications. They have but a very ſmall trade; but there is a town at the bottom of the bay independent of the Dutch, whoſe prince can bring 20,000 men into the field. The Dutch fort is large, and the governor's lodgings are at a good diſtance from the gate; ſo that, when there was a ſkirmiſh between the factory and the natives, he knew nothing of it till it was over. E. Long. 78. 10. N. Lat. 12. 0.

Cananor, a ſmall kingdom of Aſia, on the coaſt of Malabar, whoſe king can raiſe a conſiderable army. The natives are generally Mahometans; and the country produces pepper, cardamoms, ginger, mirobolans, and tamarinds, in which they drive a conſiderable trade.

CANARA, a kingdom of Aſia, on the coaſt of Malabar. The inhabitants are Gentoos, or Pagans; and there is a pagod, or temple, called *Ramtrut*, which is viſited every year by a great number of pilgrims. Here the cuſtom of burning the wives with their huſbands had its beginning, and is practiſed to this day. The country is generally governed by a woman, who keeps her court at a town called *Baydor*, two days journey from the ſea. She may marry whom ſhe pleaſes; and is not obliged to burn with her huſband, like her female ſubjects. They are ſo good obſervers of their laws, that a robbery or murder is ſcarce ever heard of among them. The Canarans have forts built of earth along the coaſt, which are garriſoned with 200 or 300 ſoldiers, to guard againſt the robberies of their neighbours.

Fig. 1. Perspective VIEW of part of a CANAL with Locks.






Thackara & Vallance sculp.

bours. The lower grounds yield every year two crops of corn or rice; and the higher produce pepper, betel nuts, sanders wood, iron and steel. The Portuguese clergy here live very loosely, and make no scruple of procuring women for strangers.

CANARIA, (anc. geog.) one of the Fortunate Islands, a proof that these were what are now called the *Canaries*. Canaria had its name from its abounding with dogs of an enormous size, two of which were brought to Juba king of Mauritania. See the following article.

CANARIA, or the GRAND CANARY, an island in the Atlantic Ocean, about 180 miles from the coast of Africa. It is about 100 miles in circumference, and 33 in diameter. It is a fruitful island, and famous for the wine that bears its name. It also abounds with apples, melons, oranges, citrons, pomegranates, figs, olives, peaches, and plantains. The fir and palm trees are the most common. The towns are, Canary the capital, Gualdera, and Geria.

CANARY, or CIVIDAD DE PALMAS, is the capital of the island of Canaria, with an indifferent castle, and a bishop's see. It has also a court of inquisition, and the supreme council of the rest of the Canary-islands; as also four convents, two for men and two for women. The town is about three miles in compass, and contains 12,000 inhabitants. The houses are only one story high, and flat at the top; but they are well built. The cathedral is a handsome structure. W. Long. 15. 20. N. Lat. 28. 4.

*CANARY-Islands*, are situated in the Atlantic ocean, over against the empire of Morocco in Africa. They were formerly called the *Fortunate Islands*, on account of the temperate healthy air, and excellent fruits. The land is very fruitful, for both wheat and barley produce 130 for one. The cattle thrive well, and the woods are full of all sorts of game. The Canary singing birds are well known all over Europe and America. There are here sugar-canes in great abundance; but the Spaniards first planted vines here, from whence we have the wine called *Canary* or *Sack*.

These islands were not entirely unknown to the ancients; but they were a long while forgot, till John de Betencourt discovered them in 1402. It is said they were first inhabited by the Phœnicians, or Carthaginians, but on no certain foundation; nor could the inhabitants themselves tell from whence they were derived; on the contrary, they did not know there was any other country in the world. Their language, manners, and customs, had no resemblance to those of their neighbours. However, they were like the people on the coast of Barbary in complexion. They had no iron. After the discovery, the Spaniards soon got possession of them all, under whose dominions they are to this day, except Madeira, which belongs to the Portuguese. The inhabitants are chiefly Spaniards; though there are some of the first people remaining, whom they call *Guanches*, who are somewhat civilized by their intercourse with the Spaniards. They are a hardy, active, bold people, and live on the mountains. Their chief food is goat's milk. Their complexion is tawny, and their noses flat. The Spanish vessels, when they sail for the West-Indies, always rendezvous at these islands going and coming. Their number is 12. 1. Alegranza; 2. Canaria; 3. Ferro; 4. Fuerteventura; 5. Gomera; 6. Gratiosa; 7. Lancerotta; 8. Madeira; 9. Palma; 10. Rocca; 11. Salvages; 12. Teneriff. West longitude from 12. to 21. north latitude from 27. 30. to 29. 30.



*CANARY-bird*. See FRINGILLA. These birds are much admired for their singing, and take their name from the place from whence they originally came, *viz*. the Canary-islands; but of late years there is a sort of birds brought from Germany, and especially from Tirol, and therefore called *German birds*, which are much better than the others: though both are supposed to have originally come from the same place. The cocks never grow fat, and by some country people cannot be distinguished from common green birds; though the Canary-birds are much lustier, have a longer tail, and differ much in the heaving of the passages of the throat when they sing. These birds being so much esteemed for their song, are sometimes sold at a high price, according to the goodness and excellency of their notes; so that it will always be advisable to hear one sing before he is bought. In order to know whether he is in good health, take him out of the store-cage, and put him in a clean cage by himself; if he stand up boldly, without crouching or shrinking in his feathers, look with a brisk eye, and is not subject to clap his head under his wing, it is a sign that he is in good health; but the greatest matter is to observe his dunging: if he bolts his tail like a nightingale after he has dunged, it is a sign he is not in good health, or at least that he will soon be sick: but if his dung be very thin like water, or of a slimy white, without any blackness in it, it is a sign of approaching death. When in perfect health, his dung lies round and hard, with a fine white on the outside, dark within, and dries quickly; though a seed-bird seldom dungs so hard, unless he is very young.

Canary-birds are subject to many diseases, particularly imposthumes, which affect the head, cause them to fall suddenly from the perch, and die in a short time, if not speedily cured. The most approved medicine is an ointment made of fresh butter and capon's grease melted together. With this the top of the bird's head is to be anointed for two or three days, and it will dissolve the imposthume: but if the medicine has been too long delayed, then, after three or four times anointing, see whether the place of his head be soft; and if so, open it gently, and let out the matter, which will be like the yolk of an egg; when this is done, anoint the place, and the bird will be cured. At the same time he must have figs with his other food, and in his water a slice or two of liquorice, with white sugar-candy.

Canary-birds are distinguished by different names at different times and ages: such as are about three years old are called *runts;* and those above two are named *eriffs:* those of the first year under the care of the old ones, are termed *branchers;* those that are new flown, and cannot feed themselves, *pushers;* and those brought up by hand, *nestlings*.

The Canary-birds may be bred with us; and, if treated with proper care, they will become as vigorous and healthful as in the country from whence they have their name. The cages in which these birds are kept are to be made either of walnut-tree or oak, with bars of wire; because these, being woods of strength, do not require to be used in large pieces.

Canary-birds.

The common shape of cages, which is cylindric, is very improper for these birds; for this allows little room to walk, and without that the birds usually become melancholy. The most proper of all shapes is the high and long, but narrow.

If these birds eat too much, they grow over-fat, lose their shape, and their singing is spoiled: or at least they become so idle, that they will scarce ever sing. In this case their victual is to be given them in a much smaller quantity, and they will by this means be recovered by degrees to all their beauty, and will sing as at first.

At the time that they are about to build their nests, there must be put into their cages some hay, dried thoroughly in the sun: with this must be fixed some moss dried in the same manner, and some stag's hair; and great care is to be taken of breeding the young, in the article of food. As soon as the young birds are eight days old, or somewhat more, and are able to eat and pick up food of themselves, they are to be taken out of the cage in which they were hatched, and each put separately into another cage, and hung up in a room where it may never have an opportunity of hearing the voice of any other bird. After they have been kept thus about eight days, they are to be excited to sing by a bird-pipe; but this is not to be blowed too much, or in too shrill a manner, lest they sing themselves to death.

For the first fifteen days the cages are to be covered with a black cloth, and for the fifteen days following with a green one. Five lessons in a day from the pipe are sufficient for these young creatures; and they must not be disturbed with several sounds at the same time, lest they confound and puzzle them: two lessons should be given them early in the morning, one about the middle of the day, and two more at night.

The genius and temper of the several birds of this kind are very different. The males are almost always melancholy, and will not sing unless they are excited to it by hearing others continually singing about them. The male bird of this kind will often kill the female put to him for breeding; and when there are several females together with the males, they will often do the same to one another from jealousy. It is therefore not easy to manage the article of their breeding well in this particular, unless in this manner: let two female birds be put into one cage, and when they have lived together some time, they will have contracted a sort of love for one another, which will not easily be dissolved. Put a male bird into the cage with these two, and every thing will go well; their friendship will keep them from quarrelling about his favours, and from danger of his mischievous disposition; for if he attacks one of them, in order to kill her, the other will immediately take her part; and after a few of these battles, the male will find that they are together an overmatch for him at fighting, and will then distribute his favours to them, and there will not fail of being a young breed or two, which are to be taken away from their parents, and educated as before directed. Some males watch the time of the females laying, and devour the eggs as fast as she deposits them: and others take the young ones in their beak as soon as hatched, and crush them to death against the sides of the cage, or some other way destroy them. When a male has been known once to have been guilty of this, he is to be shut up in a small cage, in the middle of the large one in which the female is breeding her young, and thus he will often comfort her with singing all day long, while she sits upon the eggs or takes care of the young ones; and when the time of taking away, to put them into separate cages, is come, the male is to be let out, and he will always after this live in friendship with the female.

Cancalle || Cancer.

If the male become sick during the time of the female's sitting or bringing up her young, he must be removed immediately, and only brought to the side of her cage at certain times, that she may see him, till he is perfectly cured; and then he is to be shut up again in his cage in the middle.

Canary-birds are various in their notes, some having a sweet song, others a lowish note, others a long song, which is best, as having the greatest variety of notes: but they sing chiefly either the titlark or nightingale notes. See *Song of Birds*.

CANCALLE, a town of France, in Upper Brittany by the sea-side, where there is a road. Here the British landed in 1758, in their way to St Maloes, where they burnt a great number of ships in the harbour, and then retired without loss. This town was in their power; but they acted like generous enemies, and did no hurt to this nor any other on the coast. W. Long. 0 13. N. Lat. 48. 41.

CANCELIER, in falconry, is when a light brown hawk, in her stooping, turns two or three times upon the wing, to recover herself before she seizes.

CANCELLI, a term used to denote lattice windows, of those made of cross bars disposed latticewise; it is also used for rails or ballusters inclosing the communion-table, a court of justice, or the like, and for the net-work in the inside of hollow bones.

CANCELLING, in the civil law, an act whereby a person consents that some former deed be rendered null and void. This is otherwise called *rescision*. The word comes from the Latin *cancellare* to encompass or pale a thing round. In the proper sense of the word, *to cancel*, is to deface an obligation, by passing the pen from top to bottom, or across it; which makes a kind of chequer lattice, which the Latins call *cancelli*.

CANCER, in zoology, a genus of insects belonging to the order of insecta aptera. The generic characters are these: they have eight legs, (seldom ten or six); besides the two large claws which answer the purpose of hands. They have two eyes at a considerable distance from each other, and for the most part supported by a kind of pedunculi or footstalks; the eyes are likewise elongated and moveable; they have two clawed palpi, and the tail is jointed. This genus includes the lobster, shrimp, &c. There are no less than 87 species of cancer, distinguished principally by the length of their tails and the margins of their breasts. The following are the most remarkable.

Common lobster.

1. The gammarus, or common lobster, with a smooth thorax, short serrated snout; very long antenæ; and between them two shorter ones, bifid; claws and fangs large, the greater tuberculated, the lesser serrated on the inner edge; four pair of legs; six joints in the tail; tail-fins rounded. It inhabits all the rocky shores of America, but chiefly where there is a depth of water. In Llyn in Wales, a certain small lobster,

Cancer.

ſter, nothing different except in ſize, burrows in the ſand. They are brought in vaſt quantities from the Orkney iſles, and many parts of the eaſtern coaſt of Scotland, to the London markets. Sixty or ſeventy thouſand are annually brought from the neighbourhood of Montroſe alone.—The lobſter was well known to the ancients, and is well deſcribed by Ariſtotle under the name of αστακος. It is found as far as the Helleſpont; and is now called at Conſtantinople *liczuda* and *licpuda*.

Lobſters fear thunder, and are apt to caſt their claws on a great clap; it is ſaid that they will do the ſame on the firing of a great gun; and that, when men of war meet a lobſter boat, a jocular threat is uſed, that, if the maſter does not ſell them good lobſters, they will *ſalute him.*

The habitation of this ſpecies is in the cleareſt water, at the foot of rocks that impend over the ſea. This has given opportunity of examining more cloſely into the natural hiſtory of the animal, than of many others who live in an element that prohibits moſt of the human reſearches, and limits the enquiries of the moſt inquiſitive. Some lobſters are taken by hand; but the greater quantity in pots, a ſort of trap formed of twigs, and baited with garbage; they are formed like a wire mouſe-trap, ſo that when the lobſter gets in, there is no return. Theſe are faſtened to a cord ſunk in the ſea, and their place marked by a buoy.—They begin to breed in the ſpring, and continue breeding moſt part of the ſummer. They propagate *more humano*, and are extremely prolific. Dr Baſter ſays he counted 12,444 eggs under the tail, beſides thoſe that remained in the body unprotruded. They depoſit thoſe eggs in the ſand, where they are ſoon hatched.

Lobſters change their cruſt annually. Previous to their putting off their old one, they appear ſick, languid and reſtleſs. They totally acquire a new coat in a few days; but during the time that they remain defenceleſs, they ſeek ſome very lonely place, for fear of being devoured by ſuch of their brethren as are not in the ſame ſituation. It is alſo remarkable, that lobſters and crabs will renew their claws, if by accident they are torn off; and it is certain they will grow again in a few weeks, though they never attain to the ſize of the firſt. They are very voracious animals, and feed on ſea-weeds, garbage, and all ſorts of dead bodies. The pincers of one of the lobſters large claws are furniſhed with knobs, and thoſe of the other are always ſerrated. With the former it keeps firm hold of the ſtalks of ſubmarine plants, and with the latter it cuts and minces its food very dexterouſly. The knobbed or *numb* claw, as the fiſhermen call it, is ſometimes on the right and ſometimes on the left ſide indifferently. It is more dangerous to be ſeized by them with the cutting claw than the other; but in either caſe, the quickeſt way to get diſengaged from the creature is to pull off its claw. The female or *hen* lobſter does not caſt her ſhell the ſame year that ſhe depoſits her ova, or, in the common phraſe, is in *berry*. When the ova firſt appear under her tail, they are ſmall and extremely black: but they become in ſucceſſion almoſt as large as ripe elder berries before they are depoſited, and turn of a dark brown colour, eſpecially towards the end of the time of her depoſiting them. They continue full, and depoſiting the ova in conſtant ſucceſſion, as long as any of that black ſubſtance can be found in their body, which, when boiled, turns of a beautiful red colour, and is called their *coral*. Hen-lobſters are found in berry at all times of the year, but chiefly in winter. It is a common miſtake, that a berried hen is always in perfection for the table. When her berries appear large and browniſh, ſhe will always be found exhauſted, watery and poor. Though the ova be caſt at all times of the year, they ſeem only to come to life during the warm ſummer months of July and Auguſt. Great numbers of them may then be found, under the appearance of tadpoles, ſwimming about the little pools left by the tides among the rocks, and many alſo under their proper form from half an inch to four inches in length. In caſting their ſhells, it is hard to conceive how the lobſter is able to draw the fiſh of their large claws out, leaving the ſhell entire and attached to the ſhell of their body, in which ſtate they are conſtantly found. The fiſhermen ſay, the lobſter pines before caſting, till the fiſh of its large claw is no thicker than the quill of a gooſe, which enables it to draw its parts through the joints and narrow paſſage near the trunk. The new ſhell is quite membranaceous at firſt, but hardens by degrees. Lobſters only grow in ſize while their ſhells are in their ſoft ſtate. They are choſen for the table, by their being heavy in proportion to their ſize; and by the hardneſs of their ſhells on their ſides, which, when in perfection, will not yield to moderate preſſure. Barnacles and other ſmall fiſh adhering to them are reckoned certain ſigns of ſuperior goodneſs. Cock-lobſters are in general better than the hens in winter; they are diſtinguiſhed by the narrowneſs of their tails, and by their having a ſtrong ſpine upon the centre of each of the tranſverſe proceſſes beneath the tail, which ſupport the four middle plates of their tails. The fiſh of a lobſter's claw is more tender, delicate, and eaſy of digeſtion, than that of the tail. In ſummer, the lobſters are found near the ſhore, and thence to about ſix fathoms water; in winter, they are ſeldom taken in leſs than 12 or 15 fathoms. Like other inſects, they are much more active and alert in warm weather than in cold. In the water, they can run nimbly upon their legs or ſmall claws; and, if alarmed, can ſpring, tail foremoſt, to a ſurpriſing diſtance, as ſwift as a bird can fly. The fiſhermen can ſee them paſs about 30 feet; and, by the ſwiftneſs of their motion, ſuppoſe they may go much further. Athenæus remarks this circumſtance, and ſays, that "the incurvated lobſters will ſpring with the activity of dolphins." Their eyes are raiſed upon moveable baſes, which enables them to ſee readily every way. When frightened, they will ſpring from a conſiderable diſtance to their hold in the rock, and, what is not leſs ſurpriſing than true, will throw themſelves into their hold in that manner through an entrance barely ſufficient for their bodies to paſs.

2. The ſtrigoſus, or plated lobſter, with a pyramidal ſpiny ſnout; thorax elegantly plated, each plate marked near its junction with ſhort ſtriæ; claws much longer than the body, thick, echinated, and tuberculated; the upper fang trifid; only three legs ſpiny on their ſides; tail broad. The largeſt of this ſpecies is about ſix inches long. It inhabits the coaſts of Angleſea, under ſtones and fuci. It is very active; and, if taken, flaps its tail againſt the body with much violence and noiſe. PlateCXV.

3. The aſtacus, or craw-fiſh, with a projecting ſnout

Cancer. Craw-fish, prawn, shrimp, &c. slightly serrated on the sides; a smooth thorax: back smooth, with two small spines on each side, claws large, beset with small tubercles; two first pair of legs clawed, the two next subulated; tail consisting of five joints; the caudal fins rounded. It inhabits many of the rivers in England, lodged in holes which they form in the clayey banks. Cardan says, that this species indicates the goodness of water; for in the best water they are boiled into the reddest colour.

4. The serratus, or prawn, with a long serrated snout bending upwards; three pair of very long filiform feelers; claws small, furnished with two fangs; smooth thorax; five joints to the tail; middle caudal fin subulated, two outmost flat and rounded. It is frequent in several shores among loose stones; sometimes found at sea, and taken on the surface over 30 fathoms depth of water; cinerous when fresh, of a fine red when boiled.

5. The crangon, or shrimp, with long slender feelers, and between them two projecting laminæ; claws with a single, hooked, moveable fang; three pair of legs; seven joints in the tail; the middle caudal fin subulated, the four others rounded and fringed, a spine on the exterior side of each of the outmost. It inhabits the shores of Britain in vast quantities, and is the most delicious of the genus.

6. The squilla, with a snout like a prawn, but deeper and thinner; the feelers longer in proportion to the bulk; the sub-caudal fins rather larger; is, at full growth, not above half the bulk of the former.—It inhabits the coasts of Kent; and is sold in London under the name of the *white shrimp*, as it assumes that colour when boiled.

7. The atomos, or atom-lobster, with a slender body; filiform antennæ; three pair of legs near the head; behind which are two pair of oval vesiculæ; beyond are three pair of legs, and a slender tail between the last pair. It is very minute, and the help of the microscope is often necessary for its inspection.

8. The pulex, or flea lobster, with five pair of legs, and two claws imperfect; with 12 joints of the body. It is very common in fountains and rivulets; swims very swiftly in an incurvated posture on its back; embraces and protects its young between the legs; does not leap.

9. The locust, or locust-lobster, with four antennæ; two pair of imperfect claws; the first joint ovated; body consists of 14 joints, in which it differs from the former. It abounds in summer, on the shore, beneath stones and algæ; leaps about with vast agility.

Hermit-crab. 10. The diogenes, soldier-crab, or hermit crab, with rough claws; the left claw is the longest (this being the only difference between the *diogenes* and *bernardus*); the legs are subulated, and serrated along the upper ridge; the tail naked and tender, and furnished with a hook, by which it secures itself in its lodging. This species is parasitic; and inhabits the empty cavities of turbinated shells, changing its habitation according to its increase of growth from the small *nerite* to the large *whelk*. Nature denies it the strong covering behind, which it hath given to others of this class; and therefore directs it to take refuge in the deserted cases of other animals. They crawl very fast with the shell on their back; and at the approach of danger draw themselves within the shell, and, thrusting out the larger claw, will pinch very hard whatever molests them. Aristotle describes it very exactly under the name of καρκινιον. By the moderns it is called the *soldier*, from the idea of its dwelling in a tent; or the *hermit*, from retiring into a cell.

It is very diverting to observe this animal when wanting to change its shell. The little soldier is seen busily parading the shore along that line of pebbles and shells which is formed by the extremest wave; still, however, dragging its old incommodious habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can find another more convenient. It is seen stopping at one shell, turning it, and passing it by; going on to another, contemplating that a while, and then slipping its tail from its old habitation to try on the new; this also is found to be inconvenient, and it quickly returns to its old shell again. In this manner it frequently changes, till at last it finds one light, roomy, and commodious; to this it adheres, though the shell be sometimes so large as to hide the body of the animal, claws and all. Yet it is not till after many trials, and many combats also, that the soldier is thus completely equipped; for there is often a contest between two of them for some well-looking favourite shell for which they are rivals. They both endeavour to take possession; they strike with their claws, they bite each other, till the weakest is obliged to yield by giving up the object of dispute. It is then that the victor immediately takes possession, and parades it in his new conquest three or four times back and forward upon the strand before his envious antagonist. When this animal is taken, it sends forth a feeble cry, endeavouring to seize the enemy with its nippers; which if it fastens upon, it will sooner die than quit the grasp.

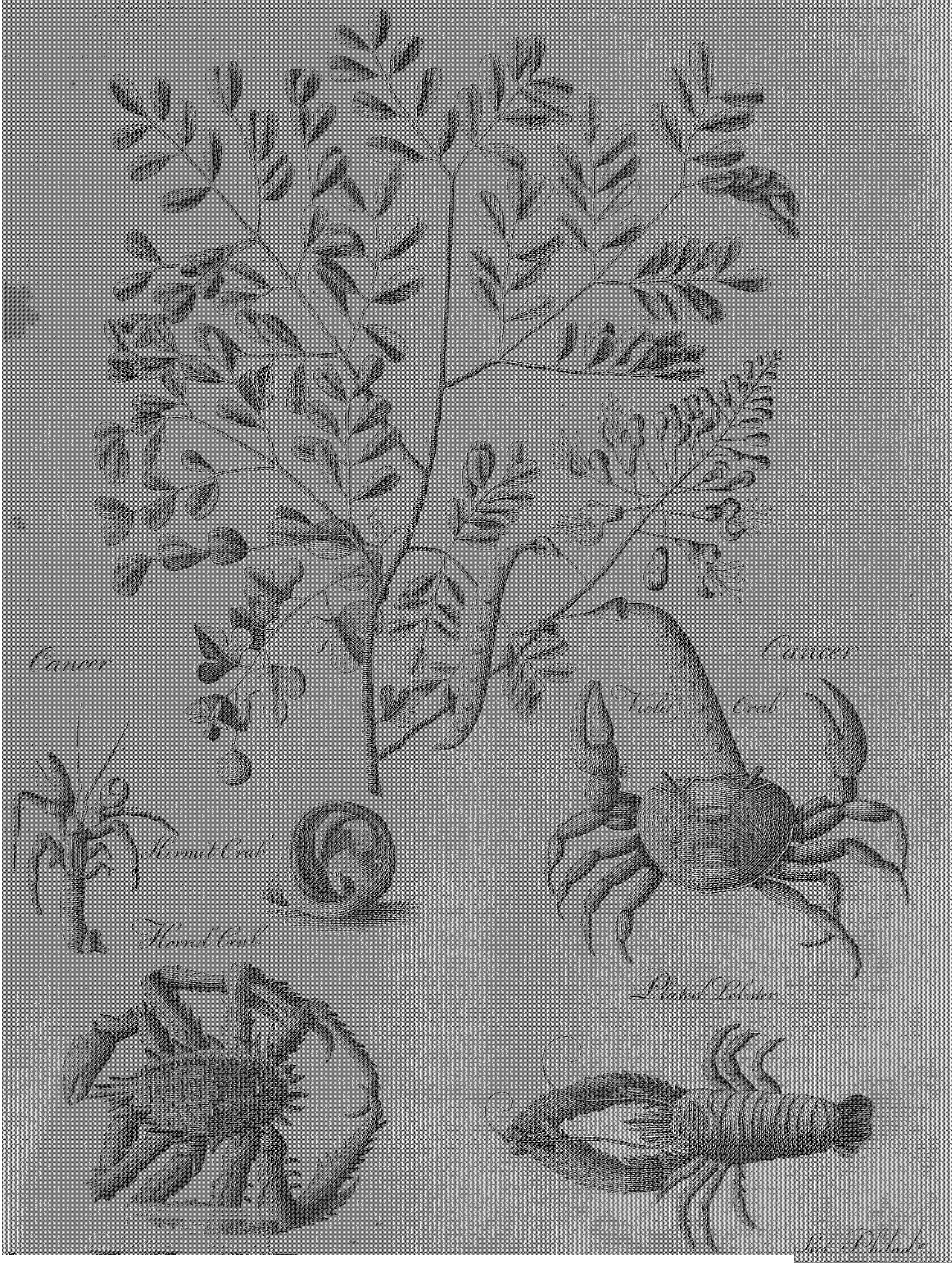
The hermit-crabs frequent mostly those parts of the sea-shores which are covered with shrubs and trees, producing various wild fruits on which they subsist; though they will also feed on the fragments of fish and other animal substances cast on shore. When roasted in the shell, they are esteemed delicate. The hermit-crab, hung in the air, dissolves into a kind of oil, which speedily cures the rheumatism, if rubbed upon the part.

11. The vocans, or sand-crab, is but of a small size; its colour light brown, or dusky white. It has eight legs and two claws, one of which is double the size of the other: these claws serve both to defend and to feed themselves with. The head has two square holes, which are receptacles for its eyes; out of which it thrusts them, and draws them in again at pleasure. Their abode is only on the sandy shores of Ilathera, and many others of the Bahama islands. They run very fast, and retreat from danger into little holes they make in the sand.

12. The grapsus, or red mottled crab, hath a round body, the legs longer and larger than in other kinds; the claws red; except which, the whole is mottled in a beautiful manner with red and white. These crabs inhabit the rocks hanging over the sea; they are the nimblest of all others, and run with surprising agility along the upright side of a rock, and even under the rocks that hang horizontally below the water. This they are often necessitated to do for escaping the assaults of rapacious birds that pursue them. These crabs never

Plate CXV

Fig. Cæsalpinia Brasiliensis
or Brasil wood Tree



Cancer. never go to land; but frequent mostly those parts of the promontories and islands of rocks in and near the sea, where, by the continual and violent agitation of the waves against the rocks, they are always wet, continually receiving the spray of the sea, which often washes them into it; but they instantly return to the rock again, not being able to live under water, and yet requiring more of that element than any of the crustaceous kinds that are not fish.

13. The granulatus, or rough-shelled crab: these crabs are pretty large, and are commonly taken from the bottom of the sea in shallow water; the legs are small in proportion to the body; the two claws are remarkably large and flat. The whole shell is covered over with innumerable little tubercles like shagreen: the colour is brown, variously stained with purple.

14. The cancer erythropus, or red-claw crab, is of a small size, and brown colour; it hath two claws of unequal bigness, red at the ends; and eight legs, which seem of less use to them than in other crabs; for when on the ground, they crawl with slow pace, dragging their bodies along; but they are mostly seen grasping with their claws, and hanging to some sea plant, or other marine substance.

The pea-crab. 15. The pisum, or pea-crab, with rounded and smooth thorax, entire and blunt; with a tail of the size of the body, which commonly is the bulk of a pea. It inhabits the muscle, and has unjustly acquired the repute of being poisonous. The swelling after eating of muscles is wholly constitutional; for one that is affected by it, hundreds remain uninjured. Crabs either of this kind, or allied to them, the ancients believed to have been the consentaneous inmates of the PINNÆ, and others bivalves; which, being too stupid to perceive the approach of their prey, were warned of it by their vigilant friend. Oppian tells the fable prettily.

In clouded deeps below, the *pinna* hides,
And through the silent paths obscurely glides;
A stupid wretch, and void of thoughtful care,
He forms no bait, nor lays the tempting snare;
But the dull sluggard boasts a *crab* his friend,
Whose busy eyes the coming prey attend.
One room contains them, and the partners dwell
Beneath the convex of one sloping shell;
Deep in the watery vast the comrades rove,
And mutual interest binds their constant love;
That wiser friend the lucky juncture tells,
When in the circuit of his gaping shells
Fish wand'ring enter; then the bearded guide
Warns the dull mate, and pricks his tender side;
He knows the hint, nor at the treatment grieves,
But hugs th' advantage, and the pain forgives;
His closing shells the *pinna* sudden joins,
And 'twixt the pressing sides his prey confines:
Thus fed by mutual aid, the friendly pair
Divide their gains, and all the plunder share.

16. The mænas, or common crab, with three notches on the front; five serrated teeth on each side; claws ovated; next joint toothed; hind feet subulated; dirty green colour; red when boiled. It inhabits all the shores; and lurks under the algæ, or burrows under the sand. Is sold, and eaten by the poor of Britain.

17. The pagurus, or black clawed crab, with a crenated thorax; smooth body; quinquedentated front; smooth claws and black tips; hind feet subulated. It inhabits the rocky coasts; is the most delicious meat of any; casts its shell between Christmas and Easter. The tips of the claws of this species are used in medicine; intended to absorb acidities in the stomach and bowels. Cancer.

18. The velutinus, or velvet crab, with the thorax quinquedentated; body covered with short, brown, velvet-like pile; claws covered with minute tubercles; small spines round the top of the second joint; hind legs broadly ovated.—This is among the species taken notice of by Aristotle on account of the broad feet, which, he says, assist them in swimming; as web-feet do the water-fowl. It inhabits the western coast of Anglesea.

19. The horridus, or horrid-crab, with a projecting bifurcated snout, the end diverging; body heart-shaped; with the claws and legs covered with long and very sharp spines.—It is a large species, and inhabits the rocks on the eastern coasts of Scotland. It is common to Norway and Scotland, as many of the marine animals and birds are.

20. The ruricola, land-crab, or violet-crab, with a smooth entire thorax, and the two last joints of the feet armed with spines. It inhabits the Bahamia islands, as well as most lands between the tropics; and feeds upon vegetables.

These animals live not only in a kind of orderly society in their retreats in the mountains, but regularly once a year march down to the sea-side in a body of some millions at a time. As they multiply in great numbers, they choose the month of April or May to begin their expedition; and then sally out by thousands from the stumps of hollow trees, from the clefts of rocks, and from the holes which they dig for themselves under the surface of the earth. At that time the whole ground is covered with this band of adventurers; there is no setting down one's foot without treading upon them. The sea is their place of destination, and to that they direct their march with right-lined precision. No geometrician could send them to their destined station by a shorter course; they neither turn to the right nor left, whatever obstacles intervene; and even if they meet with a house, they will attempt to scale the walls to keep the unbroken tenor of their way. But though this be the general order of their route, they, upon other occasions, are obliged to conform to the face of the country; and if it is intersected with rivers, they are then seen to wind along the course of the stream. The procession sets forward from the mountains with the regularity of an army under the guidance of an experienced commander. They are commonly divided into three battalions; of which the first consists of the strongest and boldest males, that, like pioneers, march forward to clear the route and face the greatest dangers. These are often obliged to halt for want of rain, and to go into the most convenient encampment till the weather changes. The main body of the army is composed of females, which never leave the mountains till the rain is set in for some time, and then descend in regular battalia, being formed into columns of 50 paces broad, and three miles deep, and so close that they almost cover the ground. Three or four days after this, the rear-guard follows, a straggling

gling undisciplined tribe, consisting of males and females, but neither so robust nor so vigorous as the former. The night is their chief time of proceeding; but if it rains by day, they do not fail to profit by the occasion; and they continue to move forward in their slow uniform manner. When the sun shines and is hot upon the surface of the ground, they then make an universal halt, and wait till the cool of the evening. When they are terrified, they march back in a confused disorderly manner, holding up their nippers, with which they sometimes tear off a piece of the skin, and then leave the weapon where they inflicted the wound. They even try to intimidate their enemies; for they often clatter their nippers together, as if it were to threaten those that come to disturb them. But tho' they thus strive to be formidable to man, they are much more so to each other; for they are possessed of one most unsocial property, which is, that if any of them by accident is maimed in such a manner as to be incapable of proceeding, the rest fall upon and devour it on the spot, and then pursue their journey.

When, after a fatiguing march, and escaping a thousand dangers, (for they are sometimes three months in getting to the shore), they have arrived at their destined port, they prepare to cast their spawn. The peas are as yet within their bodies, and not excluded as is usual in animals of this kind, under the tail; for the creature waits for the benefit of sea-water to help the delivery. For this purpose the crab has no sooner reached the shore, than it eagerly goes to the edge of the water, and lets the waves wash over its body two or three times. This seems only a preparation for bringing their spawn to maturity; for, without farther delay, they withdrew to seek a lodging upon land: in the mean time the spawn grows larger, is excluded out of the body, and sticks to the barbs under the flap, or more properly the tail. This bunch is seen as big as an hen's egg, and exactly resembling the roes of herrings. In this state of pregnancy they once more seek the shore for the last time; and shaking off their spawn into the water, leave accident to bring it to maturity. At this time whole shoals of hungry fish are at the shore in expectation of this annual supply; the sea to a great distance seems black with them; and about two-thirds of the crabs eggs are immediately devoured by these rapacious invaders. The eggs that escape are hatched under the sand; and, soon after, millions at a time of these little crabs are seen quitting the shore, and slowly travelling up to the mountains. The old ones, however, are not so active to return; they have become so feeble and lean, that they can hardly creep along, and the flesh at that time changes its colour. The most of them, therefore, are obliged to continue in the flat parts of the country till they recover, making holes in the earth, which they cover at the mouth with leaves and dirt, so that no air may enter. There they throw off their old shells, which they leave, as it were, quite whole; the place where they opened on the belly being unseen. At that time they are quite naked, and almost without motion for six days together, when they become so fat as to be delicious food. They have then under their stomachs four large white stones, which gradually decrease in proportion as the shell hardens, and, when they come to perfection, are not to be found. It is at that time that the animal is seen slowly making its way back; and all this is most commonly performed in the space of six weeks.

This animal, when possessed of its retreats in the mountains, is impregnable: for, only subsisting upon vegetables, it seldom ventures out; and its habitation being in the most inaccessible places, it remains for a great part of the season in perfect security. It is only when impelled by the desire of bringing forth its young, and when compelled to descend into the flat country, that it is taken. At that time the natives wait for its descent in eager expectation, and destroy thousands; but, disregarding their bodies, they only seek for that small spawn which lies on each side of the stomach within the shell, of about the thickness of a man's thumb. They are much more valuable upon their return after they have cast their shell; for, being covered with a skin resembling soft parchment, almost every part except the stomach may be eaten. They are taken in the holes by feeling for them with an instrument; they are sought after by night, when on their journey, by flambeaux. The instant the animal perceives itself attacked, it throws itself on its back, and with its claws pinches most terribly whatever it happens to fasten on. But the dextrous crab-catcher takes them by the hinder legs in such a manner that the nippers cannot touch him, and thus he throws them into his bag. Sometimes they are also caught when they take refuge in the bottoms of holes in rocks by the sea-side, by clapping a stick at the mouth of the hole, which prevents their getting out, and then soon after, the tide coming, enters the hole, and the animal is found, upon its retiring, drowned in its retreat.

These crabs are of various sizes, the largest about six inches wide; they walk side-ways like the sea-crab, and are shaped like them: some are black, some yellow, some red, and others variegated with red, white, and yellow mixed. Some of these are poisonous; and several people have died of eating of the crabs, particularly of the black kind. The light-coloured are reckoned best; and when full in flesh, are very well tasted. In some of the sugar islands they are eat without danger; and are no small help to the negro slaves, who, on many of these islands, would fare very hard without them.

Cancer, in medicine, a roundish, unequal, hard, and livid tumour, generally seated in the glandulous parts of the body, supposed to be so called, because it appears at length with turgid veins shooting out from it, so as to resemble, as it is thought, the figure of a crab-fish; or, others say, because like that fish, where it has once got, it is scarce possible to drive it away. See, (the *Index* subjoined to) Medicine.

Cancer, in astronomy, one of the twelve signs, represented on the globe in the form of a crab, and thus marked (♋) in books. It is the fourth constellation in the starry zodiac, and that from which one quadrant of the ecliptic takes its denomination. The reason generally assigned for its name as well as figure, is a supposed resemblance which the sun's motion in this sign bears to the crab-fish. As the latter walks backwards, so the former, in this part of his course, begins to go backwards, or recede from us; though the disposi-

disposition of stars in this sign is by others supposed to have given the first hint to the representation of a crab.

*Tropic of CANCER*, in astronomy, a lesser circle of the sphere parallel to the equator, and passing through the beginning of the sign Cancer.

CANCHERIZANTE, or CANCHERIZATO, in the Italian music, a term signifying a piece of music that begins at the end, being the retrograde motion from the end of a song, &c. to the beginning.

CANCROMA, or BOAT-BILL, in ornithology, a genus of birds belonging to the order of *Grallæ;* the characters of which are: The bill is broad, with a keel along the middle; the nostrils are small, and lodged in a furrow; the tongue is small; and the toes are divided. There are two species:

1. The Cochlearia, or Crested Boat-bill, is of the size of a fowl; the length 22 inches. The bill is four inches long, and of a singular form, not unlike a boat with the keel uppermost, or, as some think, like the bowls of two spoons, placed with the hollow parts together; the upper mandible has a prominent ridge at the top, and on each side of this a long channel, at the bottom of which the nostrils are placed; these are oval, and situated obliquely; the general colour of the bill is dusky, or in some specimens dark brown; the skin between the under jaw capable of distension: from the hind head springs a long black crest, the feathers which compose it narrow, and end in a point; the middle ones are six inches in length, the others lessen by degrees, the outer ones being not more than one inch: between the bill and the eye the skin is bare and dusky; the plumage on the forehead white; the rest of the bird of a pale bluish ash-colour; across the lower part of the neck behind is a transverse band of brownish black, which passes forwards on each side towards the breast, ending in a point, but does not encompass it: the fore part of the neck, and under parts, are bluish white, except the belly and thighs, which are rufous: the feathers which hang over the breast are loose, like those of the heron: the tail is three inches and a half long, and the wings when closed, reach nearly to the end of it: the leg is three inches in length; and the thigh, from its insertion to the knee, four; the middle toe two inches and a half; the bare part above the knee one inch and a half: the colour of the bare parts yellowish brown; claws black: the toes are connected at the base by a membrane, which, as in the umbre is the deepest in the outer one.—It inhabits Cayenne, Guiana, and Brasil, and chiefly frequents such parts as are near the water: in such places it perches on the trees, which hang over the streams, and, like the king's fisher, drops down on the fish which swim beneath. It has been thought to live on crabs likewise, whence the Linnæan name.

2. The Concrophaga, or Brown Boat-bill, a distinct species, according to Linnæus, but which Mr Lathan considers as only a variety, is of the size of the former; the head and crest the same; the upper parts, instead of ash-colour, are of a pale rufous brown; the tail rufous ash; and the under parts wholly of a cream colour; the bill and legs of a yellow brown. Its place and manners the same with those of the preceding.

CANDAHAR, a province of Persia, bounded on the north by the province of Balk; on the east, by that of Cabul; on the south, by Buchor and Sablestan; and on the west, by Sigestan. There have been bloody wars between the Indians and Persians on account of this province; but in 1650 it fell to the Persians. The inhabitants are known by the name of *Aghuans*, or *Afghans*, who have often endeavoured to throw off the yoke. But in 1737, they were severely punished for such an attempt. See PERSIA.

CANDAHAR, the capital of the above province, is seated on a mountain; and being a place of great trade, has a considerable fortress. The caravans that travel from Persia and the parts about the Caspian sea to the East Indies, choose to pass through Candahar, because there is no danger of being robbed on this road, and provisions are very reasonable. The religion is Mahometanism, but there are many Banians and Guebres. E. Long. 67. 5. N. Lat. 33. 0.

CANDAULES, the last king of Lydia, of the family of the Heraclides. See LYDIA.

CANDELARES, (from *candela* a candle), the name of an order in the former editions of Linnæus's Fragments of a natural method, consisting of these three genera, *rhizophora*, *nyssa*, and *minusops*. They are removed, in the latter editions, into the order HOLORACEÆ; which see.

CANDIA, the modern name of the island of Crete (see Crete). The word is a variation of *Khunda*, which was originally the Arabian name of the metropolis only, but in time came to be applied to the whole island.

Candia came into the possession of the Venetians by purchase in the year 1194, as related under the article CRETE: and soon began to flourish under the laws of that wise republic. The inhabitants, living under the protection of a moderate government, and being encouraged by their masters, engaged in commerce and agriculture. The Venetian commandants readily afforded to those travellers who visited the island, that assistance which is necessary to enable them to extend and improve useful knowledge. Belon, the the naturalist, is lavish in praise of their good offices, and describes, in an interesting manner, the flourishing state of that part of the island which he visited.

The seat of government was established at Candia. The magistrates and officers, who composed the council, resided there. The provisor-general was president. He possessed the chief authority; and his power extended over the whole principality. It continued in the possession of the Venetians for five centuries and an half. Cornaro held the chief command at the time when it was threatened with a storm on the side of Constantinople. The Turks, for the space of a year, had been employed in preparing a vast armament. They deceived the Venetian, by assuring him that it was intended against Malta. In the year 1645, in the midst of a solemn peace, they appeared unexpectedly before Crete with a fleet of 400 sail, having on board 60,000 land forces, under the command of four pachas. The emperor Ibrahim, under whom this expedition was undertaken, had no fair pretext to offer in justification of his enterprize. He made use of all that perfidy which characterizes the people of the east, to impose on the Venetian senate. He loaded their ambassador with presents, directed his fleet to bear for Cape Matapan, as if they had been going beyond the Archi-

Candia. Archipelago; and caused the governors or Tina and Cerigna to be solemnly assured, that the republic had nothing to fear for her possessions. At the very instant when he was making those assurances, his naval armament entered the gulf of Canea; and, passing between that city and St Theodore, anchored at the mouth of Platania.

The Venetians, not expecting this sudden attack, had made no preparations to repel it. The Turks landed without opposition. The isle of St Theodore is but a league and an half from Canea. It is only three quarters of a league in compass. The Venetians had erected two forts there; one of which, standing on the summit of the highest eminence, on the coast of that little isle, was called Turluru; the other, on a lower situation, was named St Theodore. It was an important object to the Mussulmans to make themselves masters of that rock, which might annoy their ships. They immediately attacked it with ardour. The first of those fortresses, being destitute of soldiers and cannon, was taken without striking a blow. The garrison of the other consisted of no more than 60 men. They made a gallant defence, and stood out till the last extremity; and when the Turks at last prevailed, their number was diminished to ten, whom the captain-pacha cruelly caused to be beheaded.

Being now masters of that important post, as well as of Lazaret, an elevated rock, standing about half a league from Canea, the Turks invested the city by sea and land. General Cornaro was struck, as with a thunder-clap, when he learned the descent of the enemy. In the whole island there were no more than a body of 3500 infantry, and a small number of cavalry. The besieged city was defended only by 1000 regular troops, and a few citizens, who were able to bear arms. He made haste to give the republic notice of his distress; and posted himself off the road, that he might the more readily succour the besieged city. He threw a body of 250 men into the town, before the lines of the enemy were completed. He afterwards made several attempts to strengthen the besieged with other reinforcements; but in vain. The Turks had advanced in bodies close to the town, had carried a half-moon battery, which covered the gate of Retimo; and were battering the walls night and day with their numerous artillery. The besieged defended themselves with resolute valour, and the smallest advantage which the besiegers gained cost them dear. General Cornaro made an attempt to arm the Greeks, particularly the Spachiots, who boasted loudly of their valour. He formed a battalion of these. But the æra of their valour was long past. When they beheld the enemy, and heard the thunder of the cannon, they took to flight; not one of them would stand fire.

While the senate of Venice were deliberating on the means to be used for relieving Canea, and endeavouring to equip a fleet, the Mahometan generals were sacrificing the lives of their soldiers to bring their enterprise to a glorious termination. In different engagements they had already lost 20,000 warriors; but, descending into the ditches, they had undermined the walls, and blown up the most impregnable forts with explosions of powder. They sprung one of those mines beneath the bastion of St Demetri. It overturned a considerable part of the wall, which crushed all the defenders of the bastion. That instant the besiegers sprung up with their sabres in their hands, and taking advantage of the general consternation of the besieged on that quarter, made themselves masters of the post. The besieged, recovering from their terror, attacked them with unequalled intrepidity. About 400 men assailed 2000 Turks already firmly posted on the wall, and pressed upon them with such obstinate and dauntless valour, that they killed a great number, and drove the rest down into the ditch. In this extremity, every person in the city was in arms. The Greek monks took up muskets; and the women, forgetting the delicacy of their sex, appeared on the walls among the defenders, either supplying the men with ammunition and arms, or fighting themselves; and several of those daring heroines lost their lives.

For 50 days the city held out against all the forces of the Turks. If, even at the end of that time, the Venetians had sent a naval armament to its relief, the kingdom of Candia might have been saved. Doubtless, they were not ignorant of this well known fact. The north wind blows straight into the harbour of Canea. When it blows a little briskly, the sea rages. It is then impossible for any squadron of ships, however numerous, to form in line of battle in the harbour, and to meet an enemy. If the Venetians had set out from Cerigo with a fair wind, they might have reached Canea in five hours, and might have entered the harbour with full sails, without being exposed to one cannon-shot; while none of the Turkish ships would have dared to appear before them; or if they had ventured, must have been driven back on the shore, and dashed in pieces among the rocks. But, instead of thus taking advantage of the natural circumstances of the place, they sent a few galleys, which, not daring to double Cape Spada, coasted along the southern shore of the island, and failed of accomplishing the design of their expedition.

At last, the Caneans, despairing of relief from Venice, seeing three breaches made in their walls, thro' which the infidels might easily advance upon them, exhausted with fatigue, and covered with wounds, and reduced to the number of 500 men, who were obliged to scatter themselves round the walls, which were half a league in extent, and undermined in all quarters, demanded a parley, and offered to capitulate. They obtained very honourable conditions; and after a glorious defence of two months, which cost the Turks 20,000 men, marched out of the city with the honours of war. Those citizens, who did not chuse to continue in the city, were permitted to remove; and the Ottomans, contrary to their usual practice, faithfully observed their stipulations.

The Venetians, after the loss of Canea, retired to Retimo. The captain-pacha laid siege to the citadel of the Sude, situated in the entrance of the bay, on an high rock, of about a quarter of a league in circumference. He raised earthen-batteries, and made an ineffectual attempt to level its ramparts. At last, despairing of taking it by assault, he left some forces to block it up from all communication, and advanced towards Retimo. That city, being unwalled, was defended by a citadel, standing on an eminence which overlooks the harbour. General Cornaro had retired thither. At the approach of the enemy, he advanced from

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Candia. from the city, and waited for them in the open field. In the action, inattentive to his own safety, he encouraged the soldiers, by fighting in the ranks. A glorious death was the reward of his valour: but his fall determined the fate of Retimo.

The Turks having landed additional forces on the island, they introduced the plague, which was almost a constant attendant on their armies. This dreadful pest rapidly advanced, and, like a devouring fire, wasting all before it, destroyed most part of the inhabitants. The rest, fleeing in terror before its ravages, escaped into the Venetian territories, and the island was left almost desolate.

The siege of the capital commenced in 1646, and was protracted much longer than that of Troy. Till the year 1648, the Turks scarcely gained any advantages before that city. They were often routed by the Venetians, and sometimes compelled to retire to Retimo. At that period Ibrahim was solemnly deposed, and his eldest son, at the age of nine years, was raised to the throne, under the name of Mahomet IV. Not satisfied with confining the sultan to the horrors and obscurity of a dungeon, the partizans of his son strangled him on the 19th of August, in the same year. That young prince, who mounted the throne by the death of his father, was afterwards expelled from it, and condemned to pass the remainder of his life in confinement.

In the year 1649, Ussein Pacha, who blockaded Candia, receiving no supplies from the Porte, was compelled to raise the siege, and retreat to Canea. The Venetians were then on the sea with a strong squadron. They attacked the Turkish fleet in the bay of Smyrna, burnt 12 of their ships and 2 gallies, and killed 6000 of their men. Some time after, the Mahometans having found means to land an army on Candia, renewed the siege of the city with greater vigour, and made themselves masters of an advanced fort that was very troublesome to the besieged; which obliged them to blow it up.

From the year 1650 till 1658, the Venetians, continuing masters of the sea, intercepted the Ottomans every year in the straits of the Dardanelles, and fought them in four naval engagements; in which they defeated their numerous fleets, sunk a number of their caravels, took others, and extended the terror of their arms even to the the walls of Constantinople. That capital became a scene of tumult and disorder. The Grand Signior alarmed, and trembling for his safety, left the city with precipitation.

Such glorious success revived the hopes of the Venetians, and depressed the courage of the Turks. They converted the siege of Candia into a blockade, and suffered considerable losses. The Sultan, in order to exclude the Venetian fleet from the Dardanelles, and to open to his own navy a free and safe passage, caused two fortresses to be built at the entrance of the straits. He gave orders to the Pacha of Canea to appear again before the walls of Candia, and to make every possible effort to gain the city. In the mean time, the republic of Venice, to improve the advantages which they had gained, made several attempts on Canea. In 1660, that city was about to surrender to their arms, when the Pacha of Rhodes, hastening to its relief, reinforced the defenders with a body of 2000 men. He happily doubled the extremity of Cape Melec, though within sight of the Venetian fleet, which was becalmed off Cape Spada, and could not advance one fathom to oppose an enemy, considerably weaker than themselves.

Kiopruli, son and successor to the visir of that name, who had long been the support of the Ottoman empire, knowing that the murmurs of the people against the long continuance of the siege of Candia were rising to an height, and fearing a general revolt, which would be fatal to himself and his master, set out from Byzantium, about the end of the year 1666, at the head of a formidable army. Having escaped the Venetian fleet, which was lying off Canea with a view to intercept him, he landed at *Palio Castro*, and formed his lines around Candia. Under his command were four Pachas, and the flower of the Ottoman forces. Those troops, being encouraged by the presence and the promises of their chiefs, and supported by a great quantity of artillery, performed prodigies of valour. All the exterior forts were destroyed. Nothing now remained to the besieged but the bare line of the walls, unprotected by fortresses; and these being battered by an incessant discharge of artillery, soon gave way on all quarters. Still, however, what posterity may perhaps regard as incredible, the Candians held out three years against all the forces of the Ottoman empire. At last they were going to capitulate, when the hope of assistance from France reanimated their valour and rendered them invincible. The expected succours arrived on the 26th of June 1669. They were conducted by the duke of Noailles. Under his command were a great number of French noblemen, who came to make trial of their skill in arms against the Turks.

Next day after their arrival, the ardour of the French prompted them to make a general sally. The duke of Beaufort, admiral of France, assumed the command of the forlorn hope. He was the first to advance against the Mussulmans, and was followed by a numerous body of infantry and cavalry. They advanced furiously upon the enemy, attacked them within their trenches, forced the trenches, and would have compelled them to abandon their lines and artillery, had not an unforeseen accident damped their courage. In the midst of the engagement a magazine of powder was set on fire; the foremost of the combatants lost their lives; the French ranks were broken; several of their leaders, among whom was the duke of Beaufort, disappeared for ever; the soldiers fled in disorder: and the duke of Noailles, with difficulty, effected a retreat within the walls of Candia. The French accused the Italians of having betrayed them; and on that pretext prepared to set off sooner than the time agreed upon. No intreaties of the commandant could prevail with them to delay their departure; so they reimbarked. Their departure determined the fate of the city. There were now no more than five hundred men to defend it. Morosini capitulated with Kiopruli, to whom he surrendered the kingdom of Crete, excepting only the Sude, Grabusa, and Spina-Longua. The grand visir made his entrance into Candia on the 4th of October 1670; and stayed eight months in that city, inspecting the reparation of its walls and fortresses.

The three fortresses left in the hands of the Venetians

Candia.

tians by the treaty of capitulation remained long after in their poſſeſſion. At laſt they were all taken, one after another. In ſhort, after a war of thirty years continuance, in the courſe of which more than two hundred thouſand men fell in the iſland, and it was deluged with ſtreams of Chriſtian and Mahometan blood, Candia was entirely ſubdued by the Turks, in whoſe hands it ſtill continues.

Of the climate of Candia travellers ſpeak with rapture. The heat is never exceſſive; and in the plains violent cold is never felt. In the warmeſt days of ſummer the atmoſphere is cooled by breezes from the ſea. Winter properly begins here with December and ends with January; and during that ſhort period ſnow never falls on the lower grounds, and the ſurface of the water is rarely frozen over. Moſt frequently the weather is as fine then as it is in Britain at the beginning of June. Theſe two months have received the name of *winter*, becauſe in them there is a copious fall of rain, the ſky is obſcured with clouds, and the north winds blow violently; but the rains are favourable to agriculture, the winds chaſe the clouds towards the ſummits of the mountains, where a repoſitory is formed for thoſe waters which are to fertilize the fields; and the inhabitants of the plain ſuffer no inconvenience from theſe tranſient blaſts. In the month of February, the ground is overſpread with flowers and riſing crops. The reſt of the year is almoſt one continued fine day. The inhabitants of Crete never experience any of thoſe mortifying returns of piercing cold, which are ſo frequently felt in Britain and even more ſouthern countries; and which, ſucceeding ſuddenly after the cheriſhing heats of ſpring, nip the bloſſoming flowers, wither the open buds, deſtroy half the fruits of the year, and are fatal to delicate conſtitutions. The ſky is always unclouded and ſerene; the winds are mild and refreſhing breezes. The radiant ſun proceeds in ſmiling majeſty along the azure vault, and ripens the fruits on the lofty mountains, the riſing hills, and the plains. The nights are no leſs beautiful; their coolneſs is delicious. The atmoſphere not being overloaded with vapours, the ſky unfolds to the obſerver's view a countleſs profuſion of ſtars; thoſe numerous ſtars ſparkle with the moſt vivid rays, and ſtrew the azure vault in which they appear fixed, with gold, with diamonds, and with rubies. Nothing can be more magnificent than this ſight, and the Cretans enjoy it for ſix months in the year.

To the charms of the climate other advantages are joined which augment their value: There are ſcarce any moraſſes in the iſland; the waters never ſtand here in a ſtate of ſtagnation; they flow in numberleſs ſtreams from the tops of the mountains, and form here and there large fountains or ſmall rivers that empty themſelves into the ſea; the elevated ſituation of their ſprings cauſe them to daſh down with ſuch rapidity, that they never loſe themſelves in pools or lakes, conſequently inſects cannot depoſit their eggs upon them, as they would be immediately hurried down into the ſea; and Crete is not infeſted like Egypt with thoſe clouds of inſects which ſwarm in the houſes, and whoſe ſting is inſufferably painful; nor is the atmoſphere here loaded with thoſe noxious vapours which riſe from marſhy grounds.

The mountains and hills are overſpread with various kinds of thyme, ſavoury, wild thyme, and with a multitude of odoriferous and balſamic plants; the rivulets which flow down the vallies are overhung with myrtles and laurel roſes; clumps of orange, citron, and almond trees, are plentifully ſcattered over the fields; the gardens are adorned with tufts of Arabian jaſmine. In ſpring, they are beſtrewed with beds of violets, ſome extenſive plains are arrayed in ſaffron; the cavities of the rocks are fringed with ſweet ſmelling dittany. In a word, from the hills, the vales, and the plains, on all hands, there ariſe clouds of exquiſite perfumes, which embalm the air, and render it a luxury to breathe it.

As to the inhabitants, the Mahometan men are generally from five feet and an half to ſix feet tall. They bear a ſtrong reſemblance to ancient ſtatues; and it muſt have been after ſuch models that the ancient artiſts wrought. The women alſo are generally beautiful. Their dreſs does not reſtrain the growth of any part of their bodies, and their ſhape therefore aſſumes thoſe admirable proportions with which the hand of the Creator has graced his faireſt workmanſhip on the earth. They are not all handſome or charming; but ſome of them are beautiful, particularly the Turkiſh ladies. In general, the Cretan women have a riſing throat, a neck gracefully rounded, black eyes ſparkling with animation, a ſmall mouth, a fine noſe, and cheeks delicately coloured with the freſh vermilion of health. But the oval of their form is different from that of Europeans, and the character of their beauty is peculiar to their own nation.

The quadrupeds belonging to the iſland are not of a ferocious temper. There are no lions, tigers, bears, wolves, foxes, nor indeed any dangerous animal here. Wild goats are the only inhabitants of the foreſts that overſpread the lofty mountains; and theſe have nothing to fear but the ball of the hunter; hares inhabit the hills and the plain; ſheep graze in ſecurity on the thyme and the heath; they are folded every night, and the ſhepherd ſleeps ſoundly without being diſturbed with the fear that wild animals may invade and ravage his folds.

The Cretans are very happy in not being expoſed to the troubleſome bite of noxious inſects, the poiſon of ſerpents, and the rapacity of the wild beaſts of the deſart. The ancients believed that the iſland enjoyed theſe ſingular advantages, on account of its having been the birth-place of Jupiter. "The Cretans (ſay Ælian) celebrate in their ſongs the beneficence of Jupiter, and the favour which he conferred on their iſland, which was the place of his birth and education, by freeing it from every noxious animal, and even rendering it unfit for nouriſhing thoſe noxious animals that are introduced into it from foreign countries."

Dittany holds the firſt rank among the medicinal plants which are produced in Crete. The praiſes beſtowed on the virtues of this plant by the ancients are altogether extravagant; yet we perhaps treat the medicinal virtues of this plant with too much contempt. Its leaf is very balſamic, and its flower diffuſes around it a delicious odour. At preſent the inhabitants of the iſland apply it with ſucceſs on various occaſions. The leaf, when dried and taken in an infuſion with a little ſugar, makes a very pleaſant drink, of a finer flavour than tea. It is there an immediate cure for a

weak

Candia. weak stomach, and enables it to recover its tone after a bad digestion.

Diseases are very rare in a country whose atmosphere is exceedingly pure; and in Candia, epidemical diseases are unknown. Fevers prevail here in summer, but are not dangerous; and the plague would be wholly unknown, had not the Turks destroyed the lazarets that were established by the Venetians, for strangers to do quarantine in. Since the period when these were demolished, it is occasionally introduced by ships from Smyrna and Constantinople. As no precautions are taken against it, it gains ground, and spreads over the island from one province to another; and as the colds and heats are never intemperate, it sometimes continues its ravages for six months at a time.

This fine country is infested with a disease somewhat less dangerous than the plague, but whose symptoms are somewhat more hideous; that disease is the leprosy. In ancient times, Syria was the focus in which it raged with most fury: and from Syria it was carried into several of the islands of the Archipelago. It is infectious, and is instantaneously communicated by contact. The victims who are attacked by it, are driven from society, and confined to little ruinous houses on the highway. They are strictly forbidden to leave these miserable dwellings, or hold intercourse with any person. Those poor wretches have generally beside their huts a small garden producing pulse, and feeding poultry; and with that support, and what they obtain from passengers, they find means to drag out a painful life in circumstances of shocking bodily distress. Their bloated skin is covered with a scaly crust, speckled with red and white spots, which afflict them with intolerable itchings. A hoarse and tremulous voice issues from the bottom of their breasts. Their words are scarce articulated; because their distemper inwardly preys upon the organs of speech. These frightful spectres gradually lose the use of their limbs. They continue to breathe till such time as the whole mass of their blood is corrupted, and their bodies entirely in a state of putrefaction. The rich are not attacked by this distemper: it confines itself to the poor, chiefly to the Greeks. But those Greeks observe strictly their four lents; and eat nothing during that time but salt fish, botorgo, salted and smoked pickled olives, and cheese. They drink plentifully of the hot and muddy wines of the island. The natural tendency of such a regimen must be, to fire the blood, to thicken the fluid part of it, and thus at length to bring on a leprosy.

Candia is at present governed by three Pachas, who reside respectively at Candia, Canea, and Retimo. The first, who is always a Pacha of three tails, may be considered as viceroy of the island. He enjoys more extensive powers than the others. To him the inspection of the forts and arsenals is entrusted. He nominates to such military employments as fall vacant, as well as to the governments of the Sude, Grabusa, Spina Longua, and Gira-petra. The governors of these forts are denominated Beys. Each of them has a constable and three general officers under him: one of whom is commander of the artillery; another of the cavalry; and the third of the janissaries.

The council of the pacha consists of a kyaia, who is the channel through which all orders are issued, and all favours bestowed; an aga of the janissaries, colonel-general of the troops, who has the chief care of the regulation of the police; two topigi bachi; a defterdar, who is treasurer-general for the imperial revenues; a keeper of the imperial treasury; and the chief officers of the army. This government is entirely military, and the power of the pacha serasquier is absolute. The justice of his sentences is never called into question; they are instantly carried into execution.

The people of the law are the mufti, who is the religious head, and the cadi. The first interprets those laws which regard the division of the patrimony among the children of a family, successions, and marriages;—in a word, all that are contained in the Koran; and he also decides on every thing that relates to the ceremonies of the Mussulman religion. The cadi cannot pronounce sentence on affairs connected with these laws, without first taking the opinion of the mufti in writing, which is named *Faitsa*. It is his business to receive the declarations, complaints, and donations of private persons; and to decide on such differences as arise among them. The pacha is obliged to consult those judges when he puts a Turk legally to death, but the pacha, who is dignified with three tails, sets himself above all laws, condemns to death, and sees his sentence executed, of his own proper authority. All the mosques have their Itam, a kind of curate, whose duty is to perform the service. There are schoolmasters in the different quarters of the city. These persons are much respected in Turkey, and are honoured with the title of Effendi.

The garrison of Candia consists of forty-six companies, composing a military force of about ten thousand men. All these forces do not reside constantly in the city, but they may be mustered in a very short time. They are all regularly paid every three months excepting the janissaries, none of whom but the officers receive pay. The different gradations of this military body do not depend on the pacha. The council of each company, consisting of veterans, and of officers in actual service, has the power of naming to them. A person can occupy the same post for no longer than two years; but the post of *Sorbagi*, or captain, which is purchased at Constantinople, is held for life. The *ousta*, or cook, is also continued in his employment as long as the company to which he belongs is satisfied with him. Each company has its almoner, denominated *imam*.

The garrisons of Canea and Retimo, formed on a similar plan, are much less numerous. The first consists of about three thousand men, the other of five hundred; but as all the male children of the Turks are enrolled among the janissaries as soon as born, the number of these troops might be greatly augmented in time of war; but, to say the truth, they are far from formidable. Most of them have never seen fire, nor are they ever exercised in military evolutions.

The pachas of Canea and Retimo are no less absolute, within the bounds of their respective provinces, than the pacha of Candia. They enjoy the same privileges with him, and their council consists of the same officers. These governors chief object is to get rich as speedily as possible; and in order to accomplish that end, they practise all the arts and cruelties of oppression, to squeeze money from the Greeks. In truth, those

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those poor wretches run to meet the chains with which they are loaded. Envy which always preys upon them, continually prompts them to take up arms. If some one among them happen to enjoy a decent fortune, the rest assiduously seek some pretence for accusing him before the pacha, who takes advantage of these dissentions to seize the property of both the parties. It is by no means astonishing, that under so barbarous a government, the number of the Greeks is daily diminished.

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| There are scarcely | 150,000 Greeks |
| in the island, sixty-five thousand of whom pay the carach. | |
| The Turks have not possessed the island for more than one hundred and twenty years; yet, as they are not exposed to the same oppression, they have multiplied in it, and raised themselves upon the ruin of the ancient inhabitants. Their number amounts to | 200,000 Turks. |
| The Jews, of whom there are not many in the Island, amount only to | 200 |
| Total is | 350,200 souls. |

This fertile country is in want of nothing but industrious husbandmen, secure of enjoying the fruit of their labours. It might maintain four times its present number of inhabitants.

Antiquity has celebrated the island of Crete as containing an hundred populous cities: and the industry of geographers has preserved their names and situations. Many of these cities contained no fewer than thirty thousand inhabitants;—and by reckoning them, on an average, at six thousand each, we shall in all probability be rather within than beyond the truth. This calculation gives for an hundred cities 600,000

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|---|---|
| By allowing the same number as inhabitants of the towns, villages, and all the rest of the island, | 600,000 |
| the whole number of the inhabitants of ancient Crete will amount to | 1,200,000 |

This number cannot be exaggerated. When Candia was in the hands of the Venetians, it was reckoned to contain nine hundred fourscore and sixteen villages.

It appears, therefore, that when the island of Crete enjoyed the blessing of liberty, it maintained to the number of eight hundred and forty-nine thousand eight hundred more inhabitants than it does at present. But since those happier times, she has been deprived of her laws by the tyranny of the Romans; has groaned under the destructive sway of the monarchs of the lower empire; has been exposed for a period of an hundred and twenty years to the ravages of the Arabians; has next passed under the dominion of the Venetians; and has at last been subjected to the despotism of the Turks, who have produced a dreadful depopulation in all the countries which have been subdued by their arms.

The Turks allow the Greeks the free exercise of their religion, but forbid them to repair their churches or monasteries; and accordingly they cannot obtain permission to repair their places of worship, or religious houses, but by the powerful influence of gold. From this article the pachas derive very considerable sums. They have twelve bishops as formerly, the first of whom assumes the title of archbishop of Gortynia. He resides at Candia; in which city the metropolitan church of the island stands. He is appointed by the patriarch of Constantinople; and has the right of nominating to all other bishoprics of the island; the names of which are, Gortynia, Cnossou, Mirabella, Hyera, Gira-petra, Arcadia, Cherronese, Lambis, Milopotamo, Retimo, Canea, Cisamo. These bishoprics are nearly the same as under the reign of the Greek emperors. The patriarch wears a triple tiara, writes his signature in red ink, and answers for all the debts of the clergy. To enable him to fulfil his engagements, he lays impositions on the rest of the bishops, and particularly on the monasteries, from which he draws very handsome contributions. He is considered as the head of the Greeks, whom he protects, as far as his slender credit goes. The orders of government are directed to him on important occasions; and he is the only one of all the Greeks in the island who enjoys the privilege of entering the city on horseback.

Candia.

Candia, is the capital of the above island, situated on its northern coast, in E. Long. 25. 0. N. Lat. 35. 30. It stands on the same situation which was formerly occupied by Heraclea, and is the seat of government under the Turks. Its walls, which are more than a league in compass, are in good repair, and defended by deep ditches, but not protected by any exterior fort. Towards the sea it has no attacks to fear; because the shallowness of the harbour renders it inaccessible to ships of war.

The Porte generally commits the government of this island to a Pacha of three tails. The principal officers, and several bodies of the Ottoman soldiery, are stationed here. This city, when under the Venetians, was opulent, commercial, and populous; but it has now lost much of its former strength and grandeur. The harbour, naturally a fine bason, in which ships are securely sheltered from every storm, is every day becoming narrower and shallower. At present it admits only boats and small ships after they have discharged a part of their freight. Those vessels, which the Turks freight at Candia, are obliged to go almost empty to the ports of Standie, whether their cargoes are conveyed to them in barks. Such inconveniences are highly unfavourable to commerce; and as government never thinks of removing them, the trade of Candia is therefore considerably decayed.

Candia, which was embellished by the Venetians with regular streets, handsome houses, a fine square, and a magnificent cistern, contains at present but a small number of inhabitants, notwithstanding the vast extent of the area inclosed within its walls. Several divisions of the city are void of inhabitants. That in which the market-place stands is the only one which discovers any stir of business, or show of affluence. The Mahometans have converted most of the Christian temples into mosques; yet they have left two churches to the Greeks, one to the Armenians, and a synagogue to the Jews. The Capuchins possess a small convent, with a chapel in which the vice-consul of France hears mass. At present he is the only Frenchman who attends it, as the French merchants have taken up their residence at Canea.

West of the city of Candia is an extensive range of hills;

hills, which are a continuation of mount Ida, and of which the extremity forms the promontory of Dion. On the way to Dion, we find Palio Castro, on the shore; a name which the modern Greeks give indifferently to all remains of ancient cities. Its situation corresponds to that of the ancient Panormus, which stood north-west from Heraclea.

The river which runs west of Candia was anciently known by the name of Triton; near the source of which Minerva sprung from the brain of Jove. Loaxus is a little farther distant. About a league east of that city, the river Ceratus flows through a delightful vale. According to Strabo, in one part of its course it runs near by Gnossus. A little beyond that, is another river supposed to be Therenus, on the banks of which, fable relates that Jupiter consummated his marriage with Juno. For the space of more than half a league round the walls of Candia there is not a single tree to be seen. The Turks cut them all down in the time of the siege, and laid waste the gardens and orchards. Beyond that extent, the country is plentifully covered with corn and fruit trees. The neighbouring hills are overspread with vineyards, which produce the malmsey of mount Ida,—worthy of preference at the table of the most exquisite connoisseur in wines. That species of wine, though little known, has a fine flavour, a very pleasant relish, and is highly esteemed in the island.

CANDIAC, (John Lewis) a premature genius, born at Candiac in the diocese of Nismes in France, in 1719. In the cradle he distinguished his letters: at 13 months, he knew them perfectly: at three years of age, he read Latin, either printed or in manuscript: at four, he translated from that tongue: at six, he read Greek and Hebrew; was master of the principles of arithmetic, history, geography, heraldry, and the science of medals; and had read the best authors on almost every branch of literature. He died of a complication of disorders, at Paris, in 1726.

CANDIDATE, a person who aspires to some public office.

In the Roman commonwealth, they were obliged to wear a white gown during the two years of their soliciting a place. This garment, according to Plutarch, they wore without any other clothes, that the people might not suspect they concealed money for purchasing votes, and also that they might more easily show to the people the scars of those wounds they had received in fighting for the defence of the commonwealth. The candidates usually declared their pretensions a year before the time of election, which they spent in making interest and gaining friends. Various arts of popularity were practised for this purpose, and frequent circuits made round the city, and visits and compliments to all sorts of persons, the process of which was called *ambitus*. See Ambitus.

CANDIDATI milites, an order of soldiers, among the Romans, who served as the emperor's body-guards to defend him in battle. They were the tallest and strongest of the whole troops, and most proper to inspire terror. They were called *candidati*, because clothed in white, either that they might be more conspicuous, or because they were considered in the way of preferment.

CANDISH, a considerable province of Asia, in the dominions of the Great Mogul, bounded by Chytor and Malva on the north, Orixa on the east, Decan on the south, and Guzarat on the west. It is populous and rich; and abounds in cotton, rice, and indigo. Brampore is the capital town.

CANDLE, a small taper of tallow, wax, or spermaceti; the wick of which is commonly of several threads of cotton, spun and twisted together.

A tallow-candle, to be good, must be half sheep's and half bullock's tallow; for hog's tallow makes the candle gutter, and always gives an offensive smell, with a thick black smoke. The wick ought to be pure, sufficiently dry, and properly twisted; otherwise the candle will emit an inconstant vibratory flame, which is both prejudicial to the eyes and insufficient for the distinct illumination of objects.

There are two sorts of tallow-candles; the one dipped, the other moulded: the former are the common candles; the others are the invention of the sieur le Brege at Paris.

As to the method of making candles in general: After the tallow has been weighed, and mixed in the due proportions, it is cut into very small pieces, that it may melt the sooner; for the tallow in lumps, as it comes from the butchers, would be in danger of burning or turning black, if it were left too long over the fire. Being perfectly melted and skimmed, they pour a certain quantity of water into it, proportionable to the quantity of tallow. This serves to precipitate to the bottom of the vessel the impurities of the tallow which may have escaped the skimmer. No water, however, must be thrown into the tallow designed for the three first dips; because the wick, being still quite dry, would imbibe the water, which makes the candles crackle in burning, and renders them of bad use. The tallow, thus melted, is poured into a tub, through a coarse sieve of horse-hair, to purify it still more, and may be used after having stood three hours. It will continue fit for use 24 hours in summer and 15 in winter. The wicks are made of spun cotton, which the tallow-chandlers buy in skains, and which they wind up into bottoms or clues. Whence they are cut out, with an instrument contrived on purpose, into pieces of the length of the candle required; then put on the sticks or broaches, or else placed in the moulds, as the candles are intended to be either dipped or moulded.

Wax-candles are made of a cotton or flaxen wick, slightly twisted, and covered with white or yellow wax. Of these, there are several kinds: some of a conical figure, used to illuminate churches, and in processions, funeral ceremonies, &c. (see Taper); others of a cylindrical form, used on ordinary occasions. The first are either made with a ladle or the hand. 1. To make wax-candles with the ladle. The wicks being prepared, a dozen of them are tied by the neck, at equal distances, round an iron circle, suspended over a large bason of copper tinned, and full of melted wax: a large ladle full of this wax is poured gently on the tops of the wicks one after another, and this operation continued till the candle arrive at its destined bigness; with this precaution, that the three first ladles be poured on at the top of the wick, the fourth at the height of $\frac{3}{4}$, the fifth at $\frac{1}{2}$, and the sixth at $\frac{1}{4}$, in order to give the candle its pyramidal form. Then the candles are taken down, kept warm, and

and rolled and ſmoothed upon a walnut-tree table, with a long ſquare inſtrument of box, ſmooth at the bottom. 2. As to the manner of making wax-candles by the hand, they begin to ſoften the wax, by working it ſeveral times in hot water, contained in a narrow but deep caldron. A piece of the wax is then taken out, and diſpoſed by little and little around the wick, which is hung on a hook in the wall, by the extremity oppoſite to the neck; ſo that they begin with the big end, diminiſhing ſtill as they deſcend towards the neck. In other reſpects the method is nearly the ſame as in the former caſe. However, it muſt be obſerved, that, in the former caſe, water is always uſed to moiſten the ſeveral inſtruments, to prevent the wax from ſticking; and in the latter, oil of olives, or lard, for the hands, &c. The cylindrical wax-candles are either made as the former, with a ladle, or drawn. Wax-candles drawn, are ſo called, becauſe actually drawn in the manner of wire, by means of two large rollers of wood, turned by a handle, which, turning backwards and forwards ſeveral times, paſs the wick through melted wax contained in a braſs baſon, and at the ſame time through the holes of an inſtrument like that uſed for drawing wire faſtened at one ſide of the baſon.

If any chandlers in Britain mix with their wares any thing deceitfully, &c. the candles ſhall be forfeited. Stat. 23 Eliz. and a tax or duty is granted on candles, by 8 and 9 Anne, cap. 6. made for ſale, of one penny a pound, beſides the duty upon tallow, by 8 Anne, cap. 9. And by 24 Geo. III. cap. 11. an additional duty of an halfpenny a pound: and by the ſame an additional duty of an halfpenny a pound is laid upon all candles imported (except thoſe of wax and ſpermaceti, for which ſee *Wax-Candles*), ſubject alſo to the two additional 5 per cents. impoſed by 19 and 22 Geo. III. beſides the duty of 2½d. formerly impoſed by 2 W. ſeſſ. 2. cap. 4. 8 Anne, cap. 9. and 9 Anne, cap. 6. And every maker of candles, other than wax candles, for ſale, ſhall annually take out a licence at L. 1. The maker of candles ſhall, in four weeks within the bills, and elſewhere in ſix weeks, after entry, clear off the duties on pain of double duty: nor ſell any after default in payment on pain of double value; 8 Anne, cap. 9. The makers of candles are not to uſe melting houſes, without making a true entry, on pain of L. 100, and to give notice of making candles to the exciſe officer for the duties: and of the number, &c. or ſhall forfeit L. 50, ſtat. 11. Geo. I. cap. 30. See alſo 23 Geo. II. cap. 21. and 26 Geo. II. cap. 32. No maker of candles for ſale ſhall begin to make candles, without notice firſt given to the officer, unleſs from September 29th to March 25th yearly, between ſeven in the morning and five in the evening, and from March 25th to September 29th, between five in the morning and ſeven in the evening, on pain of L. 10, 10 Anne, cap. 26. The penalty of obſtructing the officer is L. 20, and of removing of candles before they are ſurveyed L. 20, 8 Anne, cap. 9. The penalty of privately making candles is the forfeiture of the ſame and utenſils, and L. 100, 5 Geo. III. cap. 43. And the penalty of mingling weighed with unweighed candles, of removing them before they are weighed, or of concealing them, is the forfeiture of L. 100, 11 Geo. cap. 30. Candles, for which the duty hath been paid, may be exported, and the duty drawn back; but no draw-back ſhall be allowed on the exportation of any foreign candles imported. 8. Ann. cap. 9. 23 Geo. II. cap. 21.

The Roman candles were at firſt little ſtrings dipt in pitch, or ſurrounded with wax; though afterwards they made them of the papyrus, covered likewiſe with wax; and ſometimes alſo of ruſhes, by ſtripping off the outer rind, and only retaining the pith.—For religious offices, wax candles were uſed; for vulgar uſes, thoſe of tallow. Lord Bacon propoſes candles of divers compoſitions and ingredients, as alſo of different ſorts of wicks; with experiments of the degrees of duration, and light of each. Good houſewives bury their candles in flour or bran, which it is ſaid increaſes their laſting almoſt half.

*Experiments to determine the real and comparative value of burning* CANDLES *of different ſorts and ſizes.*

| | Numb. of candles in one pound. | Weight of one candle. | | The time one candle laſted | | The time that one pound will laſt | | The expence in 12 hours when candles are at 6d. per dozen, which alſo ſhows the proportion of the expence at any price per dozen. |
|---|---|---|---|---|---|---|---|---|
| | | Oz. | Dr. | Hr. | Min | Hr. | Min | Farthings and 100th parts. |
| Small wick | 18⅓ | 0 | 14 | 3 | 15 | 59 | 26 | 4.85 |
| Large wick. | 19 | 0 | 13⅓ | 2 | 40 | 50 | 34 | 5.70 |
| | 16½ | 0 | 15½ | 2 | 40 | 44 | 2 | 6.54 |
| | 12 | 1 | 5⅓ | 3 | 27 | 41 | 24 | 6.96 |
| * | 10¾ | 1 | 8 | 3 | 36 | 38 | 24 | 7.50 |
| * | 7¾ | 2 | 1 | 4 | 9 | 32 | 12 | 8.94 |
| * | 8 | 2 | 0 | 4 | 15 | 34 | 0 | 8.47 |
| | 5¾ | 2 | 13 | 5 | 19 | 30 | 15 | 9.53 |
| | Mould candles. | | | | | | | Mould-candle at 7s. per doz. |
| | 5⅞ | 2 | 12 | 7 | 20 | 42 | 39 | 7.87 |
| | 4 | 4 | 0 | 9 | 3 | 36 | 20 | 9.28 |

N. B. The time that one candle laſted was taken from an average of ſeveral trials in each ſize.

It is obſerveable, in optics, that the flame of two candles joined, give a much ſtronger light than both of them ſeparate. The obſervation was ſuggeſted by Dr Franklin. Probably the union of the two flames produces a greater degree of heat, whereby the vapour is attenuated, and the particles of which light conſiſts more copiouſly emitted.

*Lighting a* CANDLE *by a ſmall ſpark of electricity.* This method, which is an invention of Dr Ingenhouſz, is recorded in the Phil. Tranſ. vol. 68. It is done by a ſmall phial, having eight or ten inches of metallic coating, or even leſs, charged with electricity, which may be done at any time of the night by a perſon who has an electric machine in his room. "When I have occaſion to light a candle," ſays he, "I charge a ſmall coated phial, whoſe knob is bent outwards, ſo as to hang a little over the body of the phial; then I wrap ſome looſe cotton over the extremity of a long braſs pin or wire, ſo as to ſtick moderately faſt to its ſubſtance. I next roll this extremity of the pin wrapped up with cotton in ſome fine powder of reſin, (which I always keep in readineſs upon the table for this purpoſe, either in a wide-mouthed phial or in a

looſe

loose paper); this being done, I apply the extremity of the pin or wire to the external coating of the charged phial, and bring as quickly as possible the other extremity wrapped round with cotton to the knob: the powder of resin takes fire, and communicates its flame to the cotton, and both together burn long enough to light a candle. As I do not want more than half a minute to light my candle in this way, I find it a readier method than kindling it by a flint and steel, or calling a servant. I have found, that powder of white or yellow resin lights easier than that of brown. The *farina lycopodii* may be used for the same purpose: but it is not so good as the powder of resin, because it does not take fire quite so readily, requiring a stronger spark not to miss; besides, it is soon burnt away. By dipping the cotton in oil of turpentine, the same effect may be as readily obtained, if you take a jar somewhat greater in size. This oil will inflame so much the readier if you strew a few fine particles of brass upon it. The pin dust is the best for this purpose; but as this oil is scattered about by the explosion, and when kindled fills the room with much more smoke than the powder of resin, I prefer the last."

*Candle-Bombs*, a name given to small glass bubbles, having a neck about an inch long, with a very slender bore, by means of which a small quantity of water is introduced into them, and the orifice afterwards closed up. This stalk being put through the wick of a burning candle, the vicinity of the flame soon rarifies the water into steam, by the elasticity of which the glass is broken with a loud crack.

Candle is also a term of medicine, and is reckoned among the instruments of surgery. Thus the *candela fumalis*, or the *candela pro suffitu odorata*, is a mass of an oblong form, consisting of odoriferous powders, mixed up with a third or more of the charcoal of willow or lime tree, and reduced to a proper consistence with a mucilage of gum tragacanth, labdanum, or turpentine. It is intended to excite a grateful smell without any flame, to correct the air, to fortify the brain, and to excite the spirits.

*Medicated Candle*, the same with Bougie.

Candle. Sale or auction by inch of candle, is when a small piece of candle, being lighted, the bystanders are allowed to bid for the merchandize that is selling; but the moment the candle is out, the commodity is adjudged to the last bidder.

There is also an excommunication by inch of candle; when the sinner is allowed to come to repentance while a candle continues burning; but after it is consumed, he remains excommunicated to all intents and purposes.

*Rush-Candles*, used in different parts of England, are made of the pith of a sort of rushes, peeled or stripped of the skin, except on one side, and dipped in melted grease.

*Candle-Wood*, slips of pine about the thickness of a finger, used in some places to burn instead of candles, giving a very good light. The French inhabitants of Tortuga use slips of yellow santal-wood for the same purpose, and under the same denomination, which yields a clear flame though of a green colour.

CANDLEBERRY tree, in botany, the English name of the Myrica.



CANDLEMAS, a feast of the church held on the second day of February, in honour of the purification of the Virgin Mary. It is borrowed from the practice of the ancient Christians, who on that day used abundance of lights both in their churches and processions, in memory, as is supposed, of our Saviour's being on that day declared by Simeon "to be a light to lighten the Gentiles." In imitation of this custom, the Roman-catholics on this day consecrate all the tapers and candles which they use in their churches during the whole year. At Rome, the Pope performs that ceremony himself; and distributes wax-candles to the cardinals and others, who carry them in procession through the great hall of the Pope's palace. This ceremony was prohibited in England by an order of council in 1548.

Candlemas, in England, is made one of the four terms of the year for paying and receiving rents or borrowed money, &c.—In the courts of law, Candlemas term begins 15th January, and ends 3d February.

CANDLESTICK, an instrument to hold a candle, made in different forms, and of all sorts of matter.

The golden candlestick was one of the sacred utensils made by Moses to be placed in the Jewish tabernacle. It was made of hammered gold, a talent in weight. It consisted of seven branches supported by a base or foot. These branches were adorned at equal distances with six flowers like lilies, and with as many bowls and knobs placed alternately. Upon the stock and six branches of the candlestick were the golden lamps, which were immoveable, wherein were put oil and cotton.

These seven lamps were lighted every evening, and extinguished every morning. The lamps had their tongs or snuffers to draw the cotton in or out, and dishes underneath them to receive the sparks or droppings of the oil. This candlestick was placed in the antichamber of the sanctuary on the south side, and served to illuminate the altar of perfume and the tabernacle of the shew-bread. When Solomon had built the temple of the Lord, he placed in it ten golden candlesticks of the same form as that described by Moses, five on the north and five on the south side of the holy place: But after the Babylonish captivity, the golden candlestick was again placed in the temple, as it had been before in the tabernacle by Moses. This sacred utensil, upon the destruction of the temple by the Romans, was lodged in the temple of peace built by Vespasian; and the representation of it is still to be seen on the triumphal arch at the foot of mount Palatine, on which Vespasian's triumph is delineated.

CANDY, a large kingdom of Asia, in the island of Ceylon. It contains about a quarter of the island; and as it is encompassed with high mountains, and covered with thick forests, through which the roads and paths are narrow and difficult, the king has them guarded to prevent his subjects from going into other countries. It is full of hills, from whence rivulets proceed which are full of fish; but as they run among the rocks, they are not fit for boats: however, the inhabitants are very dexterous in turning them to water their land; which is fruitful in rice, pulse, and hemp. The king is absolute, and his subjects are idolaters. The capital town is of the same name.

Candy, a town of Asia, and capital of a kingdom of of the same name, in the island of Ceylon. It has been often burnt by the Portuguese, when they were masters of these coasts. The houses are very poor, low, and badly furnished. E. Long. 79. 12. N. Lat. 7. 35.

*Candy*, or *Sugar-Candy*, a preparation of sugar made by melting and crystallizing it six or seven times over, to render it hard or transparent. It is of three kinds, white, yellow, and red. The white comes from the loaf-sugar, the yellow from the cassonado, and the red from the muscavado.

CANDYING, the act of preserving simples in substance, by boiling them in sugar. The performance of this originally belonged to the apothecaries, but is now become a part of the business of the confectioner.

CANE, in botany. See ARUNDO and CALAMUS.

CANE, denotes also a walking stick. It is customary to adorn it with a head of gold, silver, agate, &c. Some are without knots, and very smooth and even; others are full of knots about two inches distance from one another. These last have very little elasticity, and will not bend so well as the others.

Canes of Bengal are the most beautiful which the Europeans bring into Europe. Some of them are so fine, that people work them into bowls or vessels, which being varnished over in the inside, with black or yellow lacca, will hold liquors as well as glass or China ware does; and the Indians use them for that purpose.

CANE is also the name of a long measure, which differs according to the several countries where it is used. At Naples the cane is equal to 7 feet $3\frac{1}{2}$ inches English measure: the cane of Thoulouse and the Upper Languedoc, is equal to the varre of Arragon, and contains five feet $8\frac{1}{2}$ inches; at Montpellier, Provence, Dauphine, and the Lower Languedoc, to six English feet $5\frac{1}{2}$ inches.

CANEA, a considerable town of the island of Candia, where a bashaw resides. It was built by the Venetians, and occupies part of the site of the ancient CYDONIA. It is but about two miles in compass; encircled on the land side with a single wall, extremely thick; and defended by a broad and deep ditch, cut through a bed of rock, which extends all around the wall. By cutting it still deeper, they might cause the sea to flow round its ramparts; on which they have raised high platforms, that their great guns might command a wider extent of the adjacent plain. The city has only one gate, the gate of Retimo, protected by an half-moon battery, which is the only exterior fort. The side which faces the sea is the best fortified. On the left of the harbour are four batteries, rising one above another, and planted with a number of large cannons of cast metal, marked with the arms of Venice. The first of these batteries stands close on the brink of the sea. The right side of the harbour is defended only by a strong wall, extending along a chain of pointed rocks which it is dangerous for ships to approach. At the extremity of this wall, there is an old castle, falling into ruins. Beneath that castle, the Venetians had immense arsenals, vaulted with stone. Each of these vaults was of sufficient length, breadth, and height, to serve as a work-shop for building a ship of the line. The ground is sloping, and the outermost part of these spacious arsenals is on a level with the sea; so that it was very easy to launch the ships built there into the water. The Turks are suffering that magnificent work to fall into ruins.



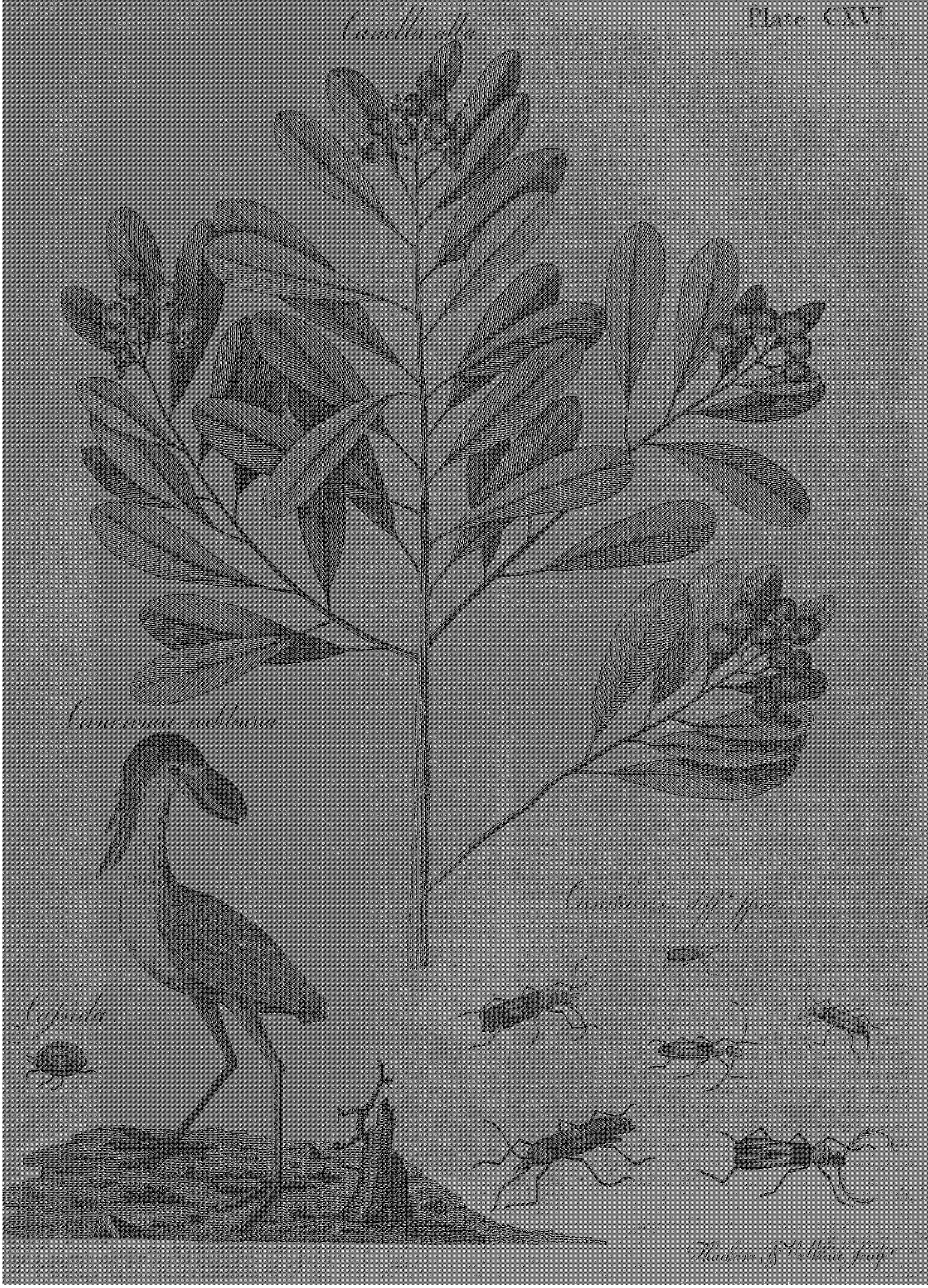
The city of Canea is laid out on a fine plan. The streets are large and straight; and the squares adorned with fountains. There are no remarkable buildings in it. Most of the houses are flat-roofed, and have only one story. Those contiguous to the harbour are adorned with galleries, from which you enjoy a delightful prospect. From the windows you discover the large bay formed between Cape Spada and Cape Melec, and all the ships that are entering in or passing out. The harbour, at present, receives ships of 200 tons burden; and it might be enlarged so as to admit the largest frigates. Its mouth is exposed to the violence of the north winds, which sometimes swell the billows above the ramparts. But, as it is narrow, and the bottom is good, ships that are well moored run no danger. At the time when Tournefort visited Crete, Canea did not contain more than five or six thousand inhabitants. But, at present, when the gates of Gira-Petra, Candia, and Retimo are choaked up, the merchants have retired to Canea; and it is reckoned to contain 16,000 souls. The environs of the town are admirable; being adorned with forests of olive-trees mixed with fields, vineyards, gardens, and brooks bordered with myrtle-trees and laural-roses. The chief revenue of this town consists in oil-olive. E. Long. 24. 15. N. Lat. 35. 23.

CANELLA, in botany: A genus of the monogynia order belonging to the dodecandria class of plants; and in the natural method ranking under the 12th order, *Holoraceæ*. The calyx is three lobed; the petals are five; the antheræ 16, growing to an urceolated or bladder-shaped nectarium; and the fruit is a trilocular berry, with two seeds. There is but one species, the alba; which grows usually about 20 feet high, and eight or ten inches in thickness, in the thick woods of most of the Bahama islands. The leaves are narrow at the stalk, growing wider at their ends, which are broad and rounding, having a middle rib only; they are very smooth, and of a light shining green. In May and June the flowers, which are pentapetalous, come forth in clusters at the ends of the branches: they are red, and very fragrant, and are succeeded by round berries, of the size of large peas, green, and when ripe (which is in February) purple, containing two shining black seeds, flat on one side, otherwise not unlike in shape to a kidney bean: these seeds in the berry are enveloped in a slimy mucilage. The whole plant is very aromatic, the bark particularly, being more used in distilling, and in greater esteem, in the more northern parts of the world than in Britain. Pl. CXVI

The bark is the canella alba of the shops. It is brought to us rolled up into long quills, thicker than cinnamon, and both outwardly and inwardly of a whitish colour, lightly inclining to yellow. Infusions of it in water are of a yellowish colour, and smell of the canella; but they are rather bitter than aromatic. Tinctures in rectified spirit have the warmth of the bark, but little of its smell. Proof-spirit dissolves the aromatic as well as the bitter matter of the canella, and is therefore the best menstruum.

The canella is the interior bark freed from an outward thin

Plate CXVI.


Canella alba
Cancroma-cochlearia
Cassida.
Cantharis. diff.t spec.
Thackara & Vallance sculp.t

thin rough one, and dried in the shade The shops distinguish two sorts of canella, differing from each other in the length and thickness of the quills: they are both the bark of the same tree; the thicker being taken from the trunk, and the thinner from the branches. This bark is a warm pungent aromatic, though not of the most agreeable kind: nor are any of the preparations of it very grateful.

Canella alba is often employed where a warm stimulant to the stomach is necessary, and as a corrigent of other articles. It is now, however, little used in composition by the London college; the only official formula which it enters being the pulvis aloeticus: but with the Edinburgh college it is an ingredient in the tinctura amara, vinum amarum, vinum rhei, &c. It is useful as covering the taste of some other articles.—This bark has been confounded with that called Winter's bark, which belongs to a very different tree. See WINTERA.

CANELLE, or CANE-LAND, a large country in the island of Ceylon, called formerly the *kingdom of Cota*. It contains a great number of cantons, the principal of which are occupied by the Dutch. The chief riches of this country consists in cinnamon, of which there are large forests. There are five towns on the coast, some forts, and a great number of harbours. The rest of the country is inhabited by the natives; and there are several rich mines, from whence they get rubies, sapphires, topazes, cats-eyes, and several other precious stones.

CANEPHORÆ, in Grecian antiquity, virgins who, when they became marriageable, presented certain baskets full of little curiosities to Diana, in order to get leave to depart out of her train, and change their state of life.

CANEPHORIA, in Grecian antiquity, a ceremony which made part of a feast, celebrated by the Athenian virgins on the eve of their marriage-day. At Athens the canephoria consisted in this; that the maid, conducted by her father and mother, went to the temple of Minerva, carrying with her a basket full of presents to engage the goddess to make the marriage-state happy; or, as the scholiast of Theocritus has it, the basket was intended as a kind of honourable amends made to that goddess, the protectrix of virginity, for abandoning her party; or as a ceremony to appease her wrath. Suidas calls it a festival in honour of Diana.

CANEPHORIA, is also the name of a festival in honour of Bacchus, celebrated particularly by the Athenians, on which the young maids carried golden baskets full of fruit, which baskets were covered, to conceal the mystery from the uninitiated.

CANES, in Egypt and other eastern countries, a poor sort of buildings for the reception of strangers and travellers. People are accommodated in these with a room at a small price, but with no other necessaries; so that, excepting the room, there are no greater accommodations in these houses than in the desarts, only that there is a market near.

CANES *Venatici*, in astronomy, the grey-hounds, two new constellations, first established by Hevelius, between the tail of the Great Bear and Bootes's arms, above the Coma Berenices. The first is called *asterion*, being that next the Bear's tail; the other *chara*. They comprehended 23 stars, of which Tycho only observed two. The longitudes and latitudes of each are given by Hevelius. In the British Catalogue they are 25.



CANETO, a strong town of Italy in the duchy of Mantua, seated on the river Oglio, which was taken by the Imperialists in 1701, by the French in 1702, afterwards by the Imperialists, and then by the French in 1705. E. Long. 10. 45. N. Lat. 40. 55.

CANGA, in the Chinese affairs, a wooden clog borne on the neck, by way of punishment for divers offences. The canga is composed of two pieces of wood notched, to receive the criminal's neck; the load lies on his shoulders, and is more or less heavy according to the quality of his offence. Some cangas weigh 200lb; the generality from 50 to 60. The Mandarins condemn to the punishment of the canga. Sentence of death is sometimes changed for this kind of punishment.

CANGE, (Charles du Fresne sieur du), one of the most learned writers of his time, was born at Amiens in 1601, and studied at the Jesuits college in that city. Afterwards he applied himself to the study of the law at Orleans, and gained great reputation by his works; among which are, 1. The history of the empire of Constantinople under the French emperors. 2. John Cinnamus's six books of the history of the affairs of John and Manuel Comnenus in Greek and Latin, with historical and philological notes. 3. *Glossarium ad Scriptores mediæ & infimæ Latinitatis.*

CANGI, CEANGI, or *Cangani*, anciently a people of Britain, concerning whose situation antiquaries have been much perplexed. They are all the same people. Cambden discovered some traces of them in many different and distant places, as in Somersetshire, Wales, Derbyshire, and Cheshire; and he might have found as plain vestiges of them in Devonshire, Dorsetshire, Essex, Wiltshire, &c. Mr Horsley and others are no less perplexed and undetermined in their opinions on this subject But Mr Baxter seems to have discovered the true cause of all this perplexity, by observing that the Cangi or Ceangi were not a distinct nation seated in one particular place, but such of the youth of many different nations as were employed in pasturage, in feeding the flocks and herds of their respective tribes. Almost all the ancient nations of Britain had their ceangi, their pastoritia pubes, the keepers of their flocks and herds, who ranged about the country in great numbers, as they were invited by the season and plenty of pasture for their cattle. This is the reason that vestiges of their name are to be found in so many different parts of Britain; but chiefly in those parts which are most fit for pasturage. These ceangi of the different British nations, naturally brave, and rendered still more hardy by their way of life, were constantly armed for the protection of their flocks from wild beasts; and these arms they occasionally employed in the defence of their country and their liberty.

CANGIAGIO, or CAMBIASI, (Ludovico) one of the most eminent of the Genoese painters, was born in 1527. His works at Genoa are very numerous; and he was employed by the king of Spain to adorn part of the Escurial. It is remarked of him, that he was not only a most expeditious and rapid painter, but also that he worked equally well with both hands;

Canicula ‖ Canine.

and by that unusual power he executed more designs, and finished more grand works with his own pencil, in a much shorter time, than most other artists could do with several assistants. He died in 1585.

In the royal collection at Paris, there is a Sleeping Cupid, as large as life, and likewise Judith with her attendant; which are painted by Cangiagio, and are an honour to that master. And in the Pembroke collection at Wilton, is a picture, reputed the work of Cangiagio, representing Christ bearing his Cross.

CANICULA, is a name proper to one of the stars of the constellation *canis major*, called also simply the *dog-star*; by the Greeks μειριος, *sirius**. Canicula is the tenth in order in the Britannic catalogue; in Tycho's and Ptolemy's it is the second. It is situated in the mouth of the constellation; and is of the first magnitude, being the largest and brightest of all the stars in the heavens. From the rising of this star not cosmically, or with the sun, but heliacally, that is, its emersion from the sun's rays, which now happens about the 15th day of August, the ancients reckoned their *dies caniculares*, or dog-days. The Egyptians and Ethiopians began their year at the rising of the canicula, reckoning to its rise again the next year, which is called the *annus canarius*, or canicular year. This year consisted ordinarily of 365 days, and every fourth year of 366, by which it was accommodated to the civil year. The reason of their choice of the canicula before the other stars to compute their time by, was not only the superior brightness of that star, but because its heliacal rising was in Egypt a time of singular note, as falling on the greatest augmentation of the Nile, the reputed father of Egypt. Ephestion adds, that from the aspect and colour of canicula, the Egyptians drew prognostics concerning the rise of the Nile; and, according to Florus, predicted the future state of the year; so that the first rising of this star was annually observed with great attention.

* See *Sirius*

CANICULUM, or CANICULUS, in the Byzantine antiquities, a golden standish or ink-vessel, decorated with precious stones, wherein was kept the sacred *encaustum*, or red ink, wherewith the emperors signed their decrees, letters, &c. The word is by some derived from *canis*, or *caniculus*; alluding to the figure of a dog which it represented, or rather because it was supported by the figures of dogs. The caniculum was under the care of a particular officer of state.

CANINA, the north part of the ancient Epirus, a province of Greece, which now belongs to the Turks, and lies off the entrance of the gulph of Venice. The principal town is of the same name, and is seated on sea-coast, at the foot of the mountains of Chimera. E. Long. 19. 25. N. Lat. 40. 55.

CANINANA, in zoology, the name of a species of serpent found in America, and esteemed one of the less poisonous kinds. It grows to about two feet long; and is green on the back, and yellow on the belly. It feeds on eggs and small birds; the natives cut off the head and tail, and eat the body as a delicate dish.

CANINE, whatever partakes of, or has any relation to, the nature of a dog.

*CANINE Appetite*, amounts to much the same with BULIMY.

*CANINE Madness*. See (the *Index* subjoined to) MEDICINE.

Canine, Canis.

*CANINE Teeth*, are two sharp edged teeth in each jaw; one on each side, placed between the incisores and molares.

CANINI, (John Angelo and Marc Anthony) brothers and Romans, celebrated for their love of antiquities. John excelled in designs for engraving on stones, particularly heads; Marc engraved them. They were encouraged by Colbert to publish a succession of heads of the heroes and great men of antiquity, designed from medals, antique stones, and other ancient remains; but John died at Rome soon after the work was begun: Marc Anthony, however, procured assistance, finished and published it in Italian in 1669. The cuts of this edition were engraved by Canini, Picard, and Valet; and a curious explanation is given, which discovers the skill of the Caninis in history and mythology. The French edition of Amsterdam, 1731, is spurious.

CANIS, or DOG, in zoology, a genus of quadrupeds, belonging to the order of feræ. The characters of the dog are these: he has six fore-teeth in the upper jaw, those in the sides being longer than the intermediate ones, which are lobated; in the under jaw there are likewise six fore-teeth, those on the sides being lobated. He has six grinders in the upper, and seven in the lower jaw. The teeth called *dog-teeth* are four, one on each side, both in the lower and upper jaw; they are sharp-pointed, bent a little inward, and stand at a distance from any of the rest.

There are 14 species of this genus, *viz.*

Domestic Dog.

I. The FAMILIARIS, or Domestic Dog, is distinguished from the other species by having his tail bent to the left side; which mark is so singular, that perhaps the tail of no other quadruped is bent in this manner. Of this species there are a great number of varieties. Linnæus enumerates 11, and Buffon gives figures of no less than 27. The mastiff is about the size of a wolf, with the sides of the lips hanging down, and a full robust body. The large Danish dog differs only from the former in being fuller in the body, and generally of a larger size. The grey-hound is likewise the same with the mastiff; but its make is more slender and delicate. Indeed the difference betwixt these three dogs, although perfectly distinguishable at first sight, is not greater than that betwixt a Dutchman, a Frenchman, and an Italian. The shepherd's dog, the wolf-dog, and what is commonly called the *Siberian dog*, to which may be joined the Lapland dog, the Canada dog, and, in general, all those which have straight ears and a pointed snout, are all one kind, differing only in thickness, the roughness or smoothness of their skin, the length of their legs and tails. The hound or beagle, the terrier, the braque or harrier, and the spaniel, may be considered as the same kind: they have the same form and the same instincts; and differ only in the length of their legs, and size of their ears, which in each of them are long, soft, and pendulous. The bull-dog, the small Danish dog, the Turkish dog, and the Iceland dog, may likewise be considered as the same kind, all the varieties in their appearance taking their rise merely from climate. For instance, the Turkish dog, which has no hair, is nothing else but the small Danish dog transported to a warm climate, which makes the hair fall off. A dog of any kind loses its hair in very warm climates. But this is not the only change which arises from difference of climate. In some countries, the voice is changed;

See Plates CXVII, CXVIII, CXIX, and CXX.

ged; in others, dogs become altogether silent. In some climates they lose the faculty of barking, and howl like wolves, or yelp like foxes. Warm climates even change their form and instincts: they turn ill-shaped, and their ears become straight and pointed. It is only in temperate climes that dogs preserve their natural courage, ardour, and sagacity.

Dr Caius has left, among several other tracts relating to natural history, one written expresly on the species of British dogs; besides a description of the variety of dogs then existing in that country, he has added a systematic table of them, which we shall here insert, and explain by a brief account of each kind.

Synopsis of British Dogs.

| | | | |
|---|---|---|---|
| I. The most generous kinds. | Dogs of chace. | Hounds. | Terrier |
| | | | Harrier |
| | | | Blood-hound |
| | | | Gaze-hound |
| | | | Grey-hound |
| | | | Leviner, or Lyemmer |
| | | | Tumbler |
| | Fowlers. | | Spaniel |
| | | | Setter |
| | | | Water-spaniel, or finder |
| | Lap Dogs. | | Spaniel gentle, or comforter |
| II. Farm Dogs. | | | Shepherd's dog |
| | | | Mastiff, or ban dog. |
| III. Mongrels. | | | Wappe |
| | | | Turnspit |
| | | | Dancer |

1. a. The first variety is the *terrarius* or terrier, which takes its name from its subterraneous employ; being a small kind of hound used to force the fox or other beasts of prey out of their holes; and in former times, rabbits out of their burrows into nets.

b. The *leverarius*, or harrier, is a species well known at present: it derives its name from its use, that of hunting the hare; but under this head may be placed the fox-hound, which is only a stronger and fleeter variety, applied to a different chace.

c. The *sanguinarius*, blood-hound, or *sleut-hounde* of the Scots, was a dog of great use, as already noticed under the article *Blood-Hound*.

The next subdivision of this species of dogs comprehends those that hunt by the eye; and whose success depends either upon the quickness of their sight, their swiftness, or their subtilty.

d. The *agasæus*, or gaze-hound, was the first: it chaced indifferently the fox, hare, or buck. It would select from the herd the fattest and fairest deer; pursue it by the eye; and, if lost for a time, recover it again by its singular distinguishing faculty; nay, should the beast rejoin the herd, this dog would fix unerringly on the same. This species is now lost, or at least unknown to us,

e. The next kind is the *leporarius*, or gre-hound. Dr Caius informs us, that it takes its name *quod præcipui gradus sit inter canes*, "the first in rank among dogs:" that it was formerly esteemed so, appears from the forest-laws of King Canute, who enacted that no one under the degree of a gentleman should presume to keep a grey-hound; and still more strongly from an old Welsh saying which signifies, that "you may know a gentleman by his hawk, his horse, and his grey-hound."

The variety called the *Highland grey-hound*, and now become very scarce, is of very great size, strong, deep-chested, and covered with long rough hair. This kind was much esteemed in former days, and used in great numbers by the powerful chieftains in their magnificent hunting-matches. It had as sagacious nostrils as the blood-hound, and was as fierce.

f. The third species is the *levinarius*, or lorarius; the leviner or lyemmer: the first name is derived from the lightness of the kind; the other from the old word *lyemme*, a thong; this species being used to be led in a thong, and slipped at the game. Our author says that this dog was a kind that hunted both by scent and sight; and in the form of its body observed a medium between the hound and grey-hound. This probably is the kind now known by the name of the *Irish grey-hound*, a dog now extremely scarce in that kingdom, the late king of Poland having procured from them as many as possible. They were of the kind called by Buffon *le grand Danois*, and probably imported there by the Danes who long possessed that kingdom. Their use seems originally to have been for the chace of wolves with which Ireland swarmed till the latter end of the last century. As soon as these animals were extirpated, the numbers of the dogs decreased; for, from that period, they were kept only for state.

g. The *vertagus*, or tumbler, is a fourth species; which took its prey by mere subtilty, depending neither on the sagacity of its nose, nor its swiftness: if it came into a warren, it neither barked, nor ran on the rabbits; but by a seeming neglect of them, or attention to something else, deceived the object till it got within reach, so as to take it by a sudden spring. This dog was less than the hound, more scraggy, had prickt up ears, and by Dr Caius's description seems to answer to the modern lurcher.

The third subdivision of the more generous dogs comprehends those which were used in fowling.

h. First, the *Hispaniolus*, or spaniel; from the name, it may be supposed that we were indebted to Spain for this breed. There were two varieties of this kind: the first used to spring the game, which are the same with the starters. The other variety was used only for the net, and was called *index*, or the setter; a kind well known at present. Britain has been long remarkable for producing dogs of this sort, particular care having been taken to preserve the breed in the utmost purity. They are still distinguished by the name of *English Spaniels;* so that, notwithstanding the derivation of the name, it is probable they are natives of Great Britain.

i. The *aquaticus*, or finder, was another species used in fowling; was the same with the water-spaniel; and was used to find or recover the game that was shot.

k. The *Melitæus*, or *fotor*, the spaniel gentle or comforter of Dr Caius (the modern lap-dog), was the last of this division. The Maltese little dogs were as much esteemed by the fine ladies of past times as those of Bologna are among the modern. Old Hollingshed is

Canis. ridiculously severe on the fair of his days for their excessive passion for these little animals; which is sufficient to prove that it was, in his time*, a novelty.

* The reign of Queen *Elizabeth*.

2. The second grand division of dogs comprehends the *rustici*, or those that were used in the country.

a. The first species is the *pastoralis*, or shepherd's dog; which is the same that is used at present, either in guarding the flocks, or in driving herds of cattle. This kind is so well trained for these purposes as to attend to every part of the herd, be it ever so large; confine them to the road; and force in every straggler, without doing it the least injury.

b. The next is the *villaticus*, or *catenarius*; the mastiff or ban dog; a species of great size and strength, and a very loud barker. Caius tells us that three of these were reckoned a match for a bear; and four for a lion; but from an experiment made in the Tower of London, that noble quadruped was found an unequal match to only three. Two of the dogs were disabled in the combat, but the third forced the lion to seek for safety by flight. The English bull-dog seems to belong to this species; and probably is the dog our author mentions under the title of *laniarius*. Great Britain was so noted for its mastiffs, that the Roman emperors appointed an officer in the island under the name of *procurator synegii*, whose sole business was to breed, and transmit from thence to the amphitheatre, such as would prove equal to the combats of the place. Gratius speaks in high terms of the excellency of the British dog.

*Cynegeticon*, lin. 175.

*Atque ipsos libeat penetrare* Britannos?
*O quanta est merces, et quantum impendia supra!*
*Si non ad speciem, mentiturosque decores*
*Protinus: hæc una est catulis jactura* Britannis.
*At magnum cum venit opus, promendaque virtus,*
*Et vocat extremo præceps discrimine Mavors,*
*Non tunc egregios tantum admirere* Molossos.

If *Britain's* distant coast we dare explore,
How much beyond the coast the valued store?
If shape and beauty not alone we prize,
Which nature to the *British* hound denies:
But when the mighty toil the huntsman warms,
And all the soul is rous'd by fierce alarms,
When Mars calls furious to th' ensanguin'd field,
Even bold *Molossians* then to these must yield.

Strabo tells us that the mastiffs of Britain were trained to war, and were used by the Gauls in their battles; and it is certain a well trained mastiff might be of use in distressing such half-armed and irregular combatants as the adversaries of the Gauls seem generally to have been before the Romans conquered them.

3. The last division is that of the *degeneres*, or curs.

a. The first of these was the *wappe*, a name derived from its note; its only use was to alarm the family by barking, if any person approached the house.

b. Of this class was the *versator*, or turn-spit; and lastly the *salitator* or dancing-dog; or such as was taught variety of tricks, and carried about by idle people as a shew. These *degeneres* were of no certain shape, being mongrels or mixtures of all kinds of dogs.

M. de Buffon has given a genealogical table of all the known dogs, in which he makes the *chien de berger*, or shepherd's dog, the origin of all, because it is naturally the most sensible. This table or tree is intended not only to exhibit th different kinds of dogs, but to give an idea of their varieties as arising from a degeneration in particular climates, and from a commixture of the different races. It is constructed in the form of a geographical chart, preserving as much as possible the position of the different climates to which each variety naturally belongs. The shepherd's dog, as already mentioned, is the root of the tree. This dog, when transported into Lapland, or other very cold climates, assumes an ugly appearance, and shrinks into a smaller size: but, in Russia, Iceland, and Siberia, where the climate is less rigorous, and the people a little more advanced in civilization, he seems to be better accomplished. These changes are occasioned solely by the influence of those climates, which produce no great alteration in the figure of this dog; for, in each of these climates, his ears are erect, his hair thick and long, his aspect wild, and he barks less frequently, and in a different manner, than in more favourable climates, where he acquires a finer polish. The Iceland dog is the only one that has not his ears entirely erect; for their extremities are a little inclined; and Iceland, of all the northern regions, has been longest inhabited by half civilized men.

Canis. See Plate CXXXI.

The same shepherd's dog, when brought into temperate climates, and among a people perfectly civilized, as Britain, France Germany, would, by the mere influence of the climate, lose his savage aspect, his erect ears, his rude, thick, long hair, and assume the figure of a bull dog, the hound, and the Irish grey-hound. The bull-dog and Irish grey-hound have their ears still partly erect, and very much resemble, both in their manners and sanguinary temper, the dog from which they derive their origin. The hound is farthest removed from the shepherd's dog; for his ears are long and entirely pendulous. The gentleness, docility, and even the timidity of the hound, are proofs of his great degeneration, or rather of the great perfection he has acquired by the long and careful education bestowed on him by man.

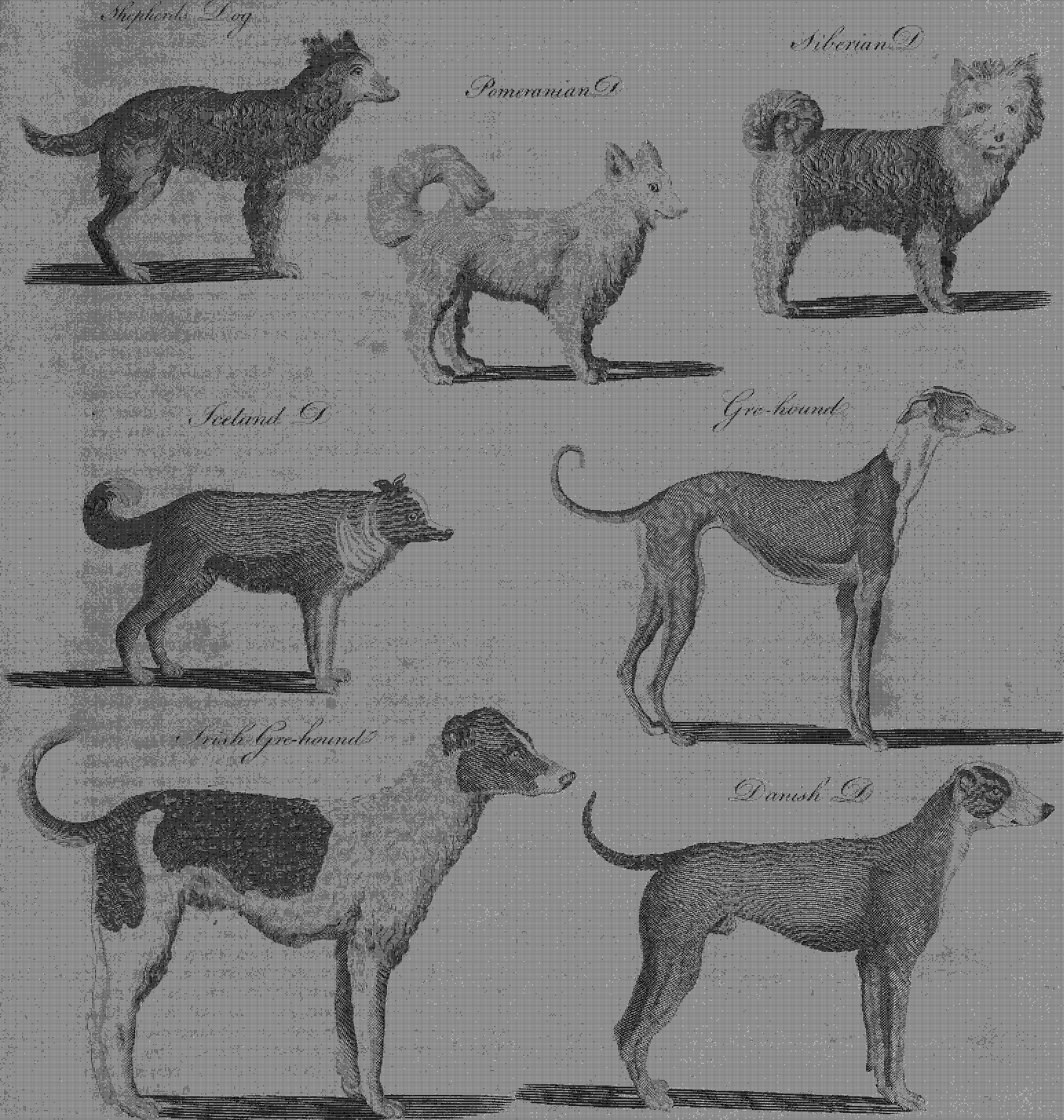
The hound, the harrier, and the terrier, constitute but one race; for, it has been remarked, that in the same litter, hounds, harriers, and terriers, have been brought forth, though the female hound had been covered by only one of these three dogs. I have joined the common harrier to the Dalmatian dog, or harrier of Bengal, because they differ only in having more or fewer spots on their coat. I have also linked the turnspit, or terrier with crooked legs, with the common terrier; because the defect in the legs of the former has originally proceeded from a disease similar to the rickets, with which some individuals had been affected, and transmitted the deformity to their descendants.

The hound, when transported into Spain and Barbary, where all animals have fine, long, bushy hair, would be converted into the spaniel and water-dog. The great and small spaniel, which differ only in size, when brought into Britain, have changed their white colour into black, and become, by the influence of climate, the great and little King Charles's dog: To these may be joined the pyrame, which is only a King-Charles's dog, black like the others, but marked with red on the four legs, and a spot of the same colour above each eye, and on the muzzle.

The Irish grey-hound, transported to the north, is become the great Danish dog; and, when carried to the south, was converted into the common grey-hound.

The

# CANIS




R. Scot Sculps Philad.

Canis.

The largest grey-hounds come from the Levant, those of a smaller size from Italy; and those Italian grey-hounds, carried into Britain, have been still farther diminished.

The great Danish dog, transported into Ireland, the Ukraine, Tartary, Epirus, and Albania, has been changed into the Irish grey-hound, which is the largest of all dogs.

The bull-dog, transported from Britain to Denmark, is become the little Danish dog; and the latter, brought into warm climates, has been converted into the Turkish dog. All these races, with their varieties, have been produced by the influence of climate, joined to the effects of shelter, food, and education. The other dogs are not pure races, but have proceeded from commixtures of those already described. I have marked, in the table, by dotted lines, the double origin of these mongrels.

The grey-hound and Irish grey-hound have produced the mongrel grey-hound, called also the grey-hound with wolf's hair. The muzzle of this mongrel is less pointed than that of the true grey-hound, which is very rare in France.

The great Danish dog and the large spaniel have produced the Calabrian dog, which is a beautiful animal, with long bushy hair, and larger than the Irish grey-hound.

The spaniel and terrier have produced the dog called *burgos*.

From the spaniel and little Danish dog has proceeded the lion-dog, which is now very rare.

The dogs with long, fine, crisped hair, called the *bouffe dogs*, and which are larger than the water-dog, proceed from the spaniel and water-dog.

The little water-dog comes from the water-dog and small spaniel.

From the bull-dog and Irish grey-hound proceeds a mongrel called the *mastiff*, which is larger than the bull-dog, and resembles the latter more than the Irish grey-hound.

The pug-dog proceeds from the bull-dog and small Danish dog.

All these dogs are simple mongrels, and are produced by the commixture of two pure races. But there are other dogs, called *double mongrels*, because they proceed from the junction of a pure race with a mongrel. The bastard pug-dog is a double mongrel from a mixture of the pug-dog with the little Danish dog. The Alicant dog is also a double mongrel, proceeding from the pug-dog and small spaniel. The Maltese, or lap-dog, is a double mongrel, produced between the small spaniel and little water-dog.

Lastly, there are dogs which may be called *triple mongrels*, because they are produced by two mixed races. Of this kind are the Artois and Islois dogs, which are produced by the pug-dog and the bastard pug-dog; to which may be added the dogs called *street-dogs*, which resemble no particular kind, because they proceed from races which have previously been several times mixed.

The following is a systematic catalogue of all the known dogs, as arranged by Mr Pennant in his History of Quadrupeds:

1. Shepherd's dog (*Canis domesticus*, Lin. *Le Chien de Berger*, Buff.); so called, because it becomes without discipline almost instantly the guardian of the flocks, keeps them within bounds, reduces the stragglers to their proper limits, and defends them from the attacks of the wolves. They have that variety in England; but it is small and weak. It is the pastoralis of Caius abovementioned. Those of France and the Alps are very large and strong; sharp-nosed; erect and sharp eared; very hairy, especially about the neck: and have their tails turned up or curled: and by accident their faces often show the marks of their combats with the wolf.

Its varieties or nearest allies are: *a*, Pomeranian dog. *b*, Siberian dog. The other varieties in the inland parts of the empire and Siberia noticed by Buffon, are chiefly from the shepherd's dog: and there is a high-limbed taper-bodied kind, the common dog of the Calmuc and independent Tartars, excellent for the chase and all uses.

2. The hound, or dog with long, smooth, and pendulous ears. This is the same with the blood-hound in Caius's Table, (*le Chien courant*, Buff. *Canis sagax*, Lin.). It is the head of the other kinds with smooth and hanging ears: *a*, Harrier; *b*, Dalmatian, vulgarly the Danish, a beautiful spotted dog; *c*, Turnspit; *d*, Water dog, great and small.

From this stock branches out another race with pendent ears, covered with long hairs, and less in size; which form,

3. The Spaniel; (*Canis avicularius*, Lin.) Those of this kind vary in size from the setting dog to the springing spaniels, and some of the little lap-dogs; as,

*a*, King Charles's. Charles II. never went out except attended by numbers of this kind. *b*, *Le pyrame* of Buffon. For this sort, though common in Britain, there is no English name. It is black, marked on the legs with red, and having a spot of the same colour above each eye. *c*, The Shock-dog.

4. Dogs with short pendent ears, and long legs and bodies; as,

*a*, Irish grey-hound; (*le Matin*, Buff.): a variety once very frequent in Ireland, and used in the chase of the wolf; now very scarce. Probably the same with the leviner in Caius's table, described above.

*b*, Common grey-hound, described above under Caius's table; (*le Levrier et Schreber*, Buff. *Canis graius*, Lin.) Its varieties are, 1. *Italian* grey-hound, small and smooth: 2. *Oriental* grey-hound, tall, slender, with very pendulous ears, and very long hairs on the tail hanging down a great length.

*c*, Danish dog, of a stronger make than a grey-hound: the largest of dogs; (*le Grand Danois*, Buff.) Mr Pennant thinks it probable, that of this kind were the dogs of Epirus, mentioned by Aristotle, lib. iii. c. 21; or those of Albania, the modern Schirwan or East Georgia, so beautifully described by Pliny, lib. viii. c. 40. Perhaps to this head may be referred the vast dogs of Thibet, said by Marco Paolo to be as big as asses, and used in that country to take wild beasts, and especially the wild oxen called *Beyamini*.

*d*, Mastiff, (*le Dogue de forte race*, Buff. *Canis molossius*, Lin.): Very strong and thick made; the head large; the lips great, and hanging down on each side: a fine and noble countenance; grows to a great size: A British kind. See above under Dr Caius's table.

5. Dogs with short pendent ears, short compact bodies,

Canis. bodies, short noses, and generally short legs. *a*. Bull-dog *(le Dogue*, Buff.), with a short nose, and under jaw longer than the upper: a cruel and very fierce kind, often biting before it barks; peculiar to England; the breed scarcer than it has been since the barbarous custom of bull-baiting has declined. *b*, Pug-dog, *(le Doguin*, Buff.): A small species; an innocent resemblance of the last. *c*, Bastard pug, *(le Roquet*, Buff.) *d*, Naked, *(le chien Turc*, Buff.): A degenerate species with naked bodies; having lost their hair by the heat of climate.

Dogs are found in the Society islands, New Zealand, and the Low islands; there are also a few in New Holland. Of these are two varieties:

*a*, Resembling the sharp-nosed pricked-ear shepherd's cur. Those of New Zeland are of the largest sort. In the Society islands they are the common food, and are fattened with vegetables, which the natives cram down their throats as we serve turkeys when they will voluntarily eat no more. They are killed by strangling, and the extravasated blood is preserved in cocoa-nut shells, and baked for the table. They grow very fat, and are allowed, even by Europeans who have got over their prejudices, to be very sweet and palatable. But the taste for the flesh of these animals was not confined to the islanders of the Pacific ocean. The ancients reckoned a young and fat dog excellent food, especially if it had been castrated: Hippocrates placed it on a footing with mutton and pork; and in another place says, that the flesh of a grown dog is wholesome and strengthening, of puppies relaxing. The Romans admired sucking puppies: they sacrificed them also to their divinities, and thought them a supper in which the gods themselves delighted.

*b*, The barbet, whose hair being long and silky, is greatly valued by the New Zelanders for trimming their ornamental dress. This variety is not eaten. The islanders never use their dogs for any purposes but what we mention; and take such care of them as not to suffer them even to wet their feet. They are excessively stupid, have a very bad nose for smelling, and seldom or never bark, only now and then howl. The New Zelanders feed their dogs entirely with fish.

The Marquesas, Friendly Islands, New Hebrides, New Caledonia, and Easter Isle, have not yet received those animals.

Having thus traced the varieties of the Dog, and noticed the peculiarities of each, we shall now give its general natural history.

From the structure of the teeth, it might be concluded *à priori* that the dog is a carnivorous animal. He does not, however, eat indiscriminately every kind of animal substance. There are some birds, as the colymbus arcticus, which the water-dog will lay hold of with keenness, but will not bring out of the water, because its smell is exceedingly offensive to him. He will not eat the bones of a goose, crow, or hawk: but he devours even the putrid flesh of most other animals. He is possessed of such strong digestive powers, as to draw nourishment from the hardest bones. When flesh cannot be procured, he will eat fish, fruits, succulent herbs, and bread of all kinds. When oppressed with sickness, to which he is very subject, especially in the beginning of summer, and before ill weather, in order to procure a puke, he eats the leaves of the quicken-grass, the bearded wheat-grass, or the rough cock's-foot grass, which gives him immediate relief. When he steals a piece of flesh, as conscious of the immorality of the action, he runs off with his tail hanging and bent in betwixt his feet. Canis.

His drink is water, which he takes in small quantities at a time, by licking with his tongue. He is in some measure obliged to lick in this manner, otherwise his nose would be immersed in the water.

His excrements are generally hard scybals, which, especially after eating bones, are white, and go by the name of *album græcum* among physicians. This album græcum was for a long time in great repute as a septic; but it is now entirely disregarded. He does not throw out his excrements promiscuously upon every thing that happens to be in the way, but upon stones, trunks of trees, or barren places. This is a wise institution of nature; for the excrements of a dog destroy almost every vegetable or animal substance. They are of such a putrid nature, that if a man's shoe touches them when recently expelled, that particular part will rot in a few days. He observes the same method in making his urine, which he throws out at a side. It is remarkable, that a dog will not pass a stone or a wall against which any other dog has pissed, without following his example, although a hundred should occur in a few minutes, in so much that it is astonishing how such a quantity can be secreted in so short a time.

The dog is an animal not only of quick motion, but remarkable for travelling very long journeys. He can easily keep up with his master, either on foot or horseback, for a whole day. When fatigued, he does not sweat, but lolls out his tongue. Every kind of dog can swim; but the water-dog excels in that article.

The dog runs round when about to lie down, in order to discover the most proper situation. He lies generally on his breast, with his head turned to one side, and sometimes with his head above his two fore-feet. He sleeps little, and even that does not seem to be very quiet: for he often starts, and seems to hear with more acuteness in sleep than when awake. They have a tremulous motion in sleep, frequently move their legs, and bark, which is an indication of dreaming.

Dogs are possessed of the sensation of smelling in a high degree. They can trace their master by the smell of his feet in a church, or in the streets of a populous city. This sensation is not equally strong in every kind. The hound can trace game, or his master's steps, 24 hours afterwards. He barks more furiously the nearer he approaches the fowls, unless he be beat and trained to silence.

The dog eats enviously, with oblique eyes; is an enemy to beggars; bites at a stone flung at it; is fond of licking wounds; howls at certain notes in music, and often urines on hearing them.

With regard to the propagation of dogs, the females admit the males before they are 12 months old. They remain in season 10, 12, or even 15 days, during which time they will admit a variety males. They come in season generally twice in the year, and more frequently in the cold than in the hot months. The male discovers the condition of the female by the smell; but she seldom admits him the first six or seven days. One

coitus

Canis.

coitus will make her conceive a great number of young; but, when not restrained, she will admit several dogs every day: she seems to have no choice or predilection, except in favour of large dogs: from this circumstance it sometimes happens, that a small female, who has admitted a mastiff, perishes in bringing forth her young. During the time of copulation, these animals cannot separate themselves, but remain united so long as the erection subsists. This is owing to the structure of the parts. The dog has not only a bone in his penis, but in the middle of the corpus cavernosum there is a large hollow, which is blown up in the time of erection to a considerable bulk. The female, on the other hand, has a larger clitoris than perhaps any other animal: besides, a large firm protuberance rises in the time of copulation, and remains perhaps longer than that of the male, and prevents him from retiring till it subsides: accordingly, after the act of copulation is over, the male turns about in order to rest himself on his legs, and remains in that position till the parts turn flaccid. The female goes with young about nine weeks. They generally bring forth from six to twelve puppies. Those of a small size bring forth five, four, and sometimes but two. They continue to copulate and bring forth during life, which lasts generally about 14 or 15 years. The whelps are commonly blind, and cannot open their eyes till the 10th or 12th day: the males are like the dog, the females like the bitch. In the fourth month, they lose some of their teeth, which are soon succeeded by others.

The dog has such a strong resemblance to the wolf and the fox, that he is commonly supposed to be the production of one or other of these animals tamed and civilized. Buffon informs us, that he kept a young dog and a young wolf together till they were three years of age, without their discovering the least inclination to copulate. He made the same experiment upon a dog and a fox; but their antipathy was rather increased when the female was in season. From these experiments he concludes, that dogs, wolves, and foxes, are perfectly distinct genera of animals. There has, however, been lately an instance to the contrary: Mr Brooke, animal-merchant in Holborn, turned a wolf to a Pomeranian bitch in heat; the congress was immediate, and as usual between dog and bitch: she produced ten puppies. Mr Pennant saw one of them at Gordon Castle, that had very much the resemblance of a wolf, and also much of its nature; being slipped at a weak deer, it instantly caught at the animal's throat and killed it. "I could not learn (says Mr Pennant) whether this mongrel continued its species; but another of the same kind did, and stocked the neighbourhood of Fochabers, in the county of Moray (where it was kept), with a multitude of curs of a most wolfish aspect.—There was lately living a mongrel offspring of this kind. It greatly resembled its wolf parent. It was first the property of Sir Wolstein Dixey; afterwards of Sir Willughby Aston. During day it was very tame; but at night sometimes relapsed into ferocity. It never barked, but rather howled; when it came into fields where sheep were it would feign lameness, but if no one was present would instantly attack them. It had been seen in copulation with a bitch, which afterwards pupped: the breed was imagined to resemble in many respects the supposed sire. It died between the age of five and six.—The bitch will also breed with the fox. The woodman of the manor of Mongewell, in Oxfordshire, has a bitch, which constantly follows him, the offspring of a tame dog-fox by a shepherd's cur; and she again has had puppies by a dog. Since there are such authentic proofs of the further continuance of the breed, we may surely add the wolf and fox to the other supposed stocks of these faithful domestics."

With regard to the natural disposition of the dog: in a savage state, he is fierce, cruel, and voracious; but, when civilized and accustomed to live with men, he is possessed of every amiable quality. He seems to have no other desire than to please and protect his master. He is gentle, obedient, submissive, and faithful. These dispositions, joined to his almost unbounded sagacity, justly claim the esteem of mankind. Accordingly no animal is so much caressed or respected: he is so ductile, and so much formed to please, that he assumes the very air and temper of the family in which he resides.

An animal endowed with such uncommon qualities must answer many useful purposes. His fidelity and vigilance are daily employed to protect our persons, our flocks, or our goods. The acuteness of his smell gains him employment in hunting: he is frequently employed as a turnspit: at Brussels and in Holland he is trained to draw little carts to the herb-market; and in the northern regions draws a sledge with his master in it, or loaden with provisions. The Kamschatkans, Esquimaux, and Greenlanders, strangers to the softer virtues, treat these poor animals with great neglect. The former, during summer, the season in which they are useless, turn them loose to provide for themselves; and recall them in October into their usual confinement and labour: from that time till spring they are fed with fish bones and *opana*, i. e. putrid fish preserved in pits, and served up to them mixed with hot water. Those used for draught are castrated; and four, yoked to the carriage, will draw five poods, or a hundred and ninety English pounds, besides the driver; and thus loaden, will travel 30 versts, or 20 miles a-day; or if unloaden, on hardened snow, on sliders of bone, a hundred and fifty versts, or a hundred English miles.

It is pretty certain, Mr Pennant observes, that the Kamschatkan dogs are of wolfish descent; for wolves abound in that country, in all parts of Siberia, and even under the arctic circle. If their master is flung out of his sledge, they want the affectionate fidelity of the European kind, and leave him to follow, never stopping till the sledge is overturned, or else stopped by some impediment. The great traveller of the 13th century, Marco Polo, had knowledge of this species of conveyance from the merchants who went far north to traffic for the precious furs. He describes the sledges; adds, that they were drawn by six great dogs; and that they changed them and the sledges on the road, as we do at present in going post. The Kamschatkans make use of the skins of dogs for clothing, and the long hair for ornament: some nations are fond of them as a food; and reckon a fat dog a great delicacy. Both the Asiatic and American savages use these animals in sacrifices to their gods, to bespeak favour or avert evil. When the Koreki dread any infection, they kill a dog, wind the intestines round two poles, and pass between them.

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The Greenlanders are not better masters. They leave their dogs to feed on muscles or berries; unless in a great capture of seals, when they treat them with the blood and garbage. These people also sometimes eat their dogs; use the skins for coverlets, for clothing, or to border and seam their habits; and their best thread is made of the guts. These northern dogs in general are large; and in the frigid parts at least have the appearance of wolves: are usually white, with a black face; sometimes varied with black and white, sometimes all white; rarely brown or all black: have sharp noses, thick hair, and short ears; and seldom bark, but set up a sort of growl or savage howl. They sleep abroad; and make a lodge in the snow, lying with only their noses out. They swim most excellently; and will hunt in packs the ptarmigan, arctic fox, polar bear, and seals lying on the ice. The natives sometimes use them in the chase of the bear. They are excessively fierce; and, like wolves, instantly fly on the few domestic animals introduced into Greenland. They will fight among themselves even to death. Canine madness is unknown in Greenland. Being to the natives in the place of horses, the Greenlanders fasten to their sledges from four to ten; and thus make their visits in savage state, or bring home the animals they have killed. Egede says that they will travel over the ice 15 German miles in a day, or 60 English, with sledges loaden with their masters and five or six large seals.

Those of the neighbouring island of Iceland have a great resemblance to them. As to those of Newfoundland, it is not certain that there is any distinct breed: most of them are curs, with a cross of the mastiff: some will, and others will not, take the water, absolutely refusing to go in. The country was found uninhabited, which makes it more probable that they were introduced by the Europeans; who use them, as the factory does in Hudson's bay, to draw firing from the woods to the forts. The savages who trade to Hudson's bay make use of the wolfish kind to draw their furs.

It is singular, that the race of European dogs show as strong an antipathy to this American species as they do to the wolf itself. They never meet with them, but they show all possible signs of dislike, and will fall on and worry them; while the wolfish breed, with every mark of timidity, puts its tail between its legs, and runs from the rage of the others. This aversion to the wolf is natural to all genuine dogs; for it is well known that a whelp, which has never seen a wolf, will at first sight tremble, and run to its master for protection: an old dog will instantly attack it. Yet these animals may be made to breed with one another as above shown; and the following abstract of a letter from Dr Pallas to Mr Pennant, dated October 5th 1781, affords a further confirmation of the fact. "I have seen at Moscow about twenty spurious animals from dogs and black wolves. They are for the most part like wolves, except that some carry their tails higher, and have a kind of hoarse barking. They multiply among themselves: and some of the whelps are greyish, rusty, or even of the whitish hue of the arctic wolves; and one of those I saw, in shape, tail, and hair, and even in barking, so like a cur, that was it not for his head and ears, his ill-natured look, and fearfulness at the approach of man, I should hardly have believed that it was of the same breed."

The dog is liable to many diseases, as the scab, madness, &c. and he seldom wants the tænia, or tape-worm in his guts, especially if he drinks dirty water.

II. The second species of this genus is the Lupus, or Wolf. He has a long head, pointed nose, ears erect and sharp, long legs well clothed with hair; tail bushy and bending down, with the tip black; head and neck ash coloured; body generally pale brown tinged with yellow: sometimes found white, and sometimes entirely black. The wolf is larger and fiercer than a dog. His eyes sparkle, and there is a great degree of fury and wildness in his looks. He draws up his claws when he walks, to prevent his tread from being heard. His neck is short, but admits of very quick motion to either side. His teeth are large and sharp; and his bite is terrible, as his strength is great. The wolf, cruel, but cowardly and suspicious, flies from man; and seldom ventures out of the woods, except pressed by hunger: but when this becomes extreme, he braves danger, and will attack men, horses, dogs, aud cattle of all kinds; even the graves of the dead are not proof against his rapacity. These circumstances are finely described, in the following lines:

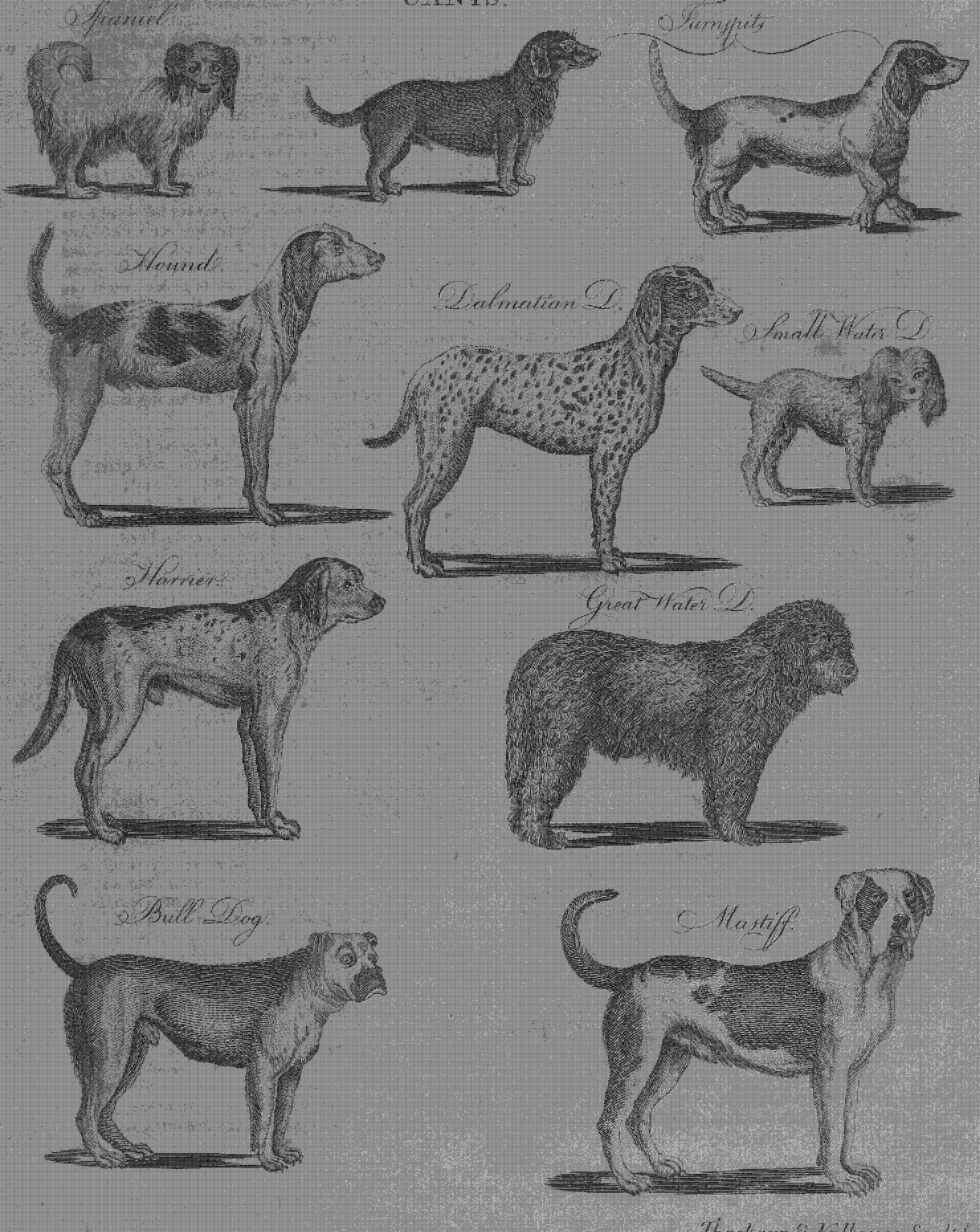
The Wolf.

By wintry famine rous'd,————
Cruel as death, and hungry as the grave!
Burning for blood! bony, and ghaunt, and grim!
Assembling wolves in raging troops descend;
And, pouring o'er the country, bear along,
Keen as the north-wind sweeps the glossy snow.
All is their prize. They fasten on the steed,
Press him to earth, and pierce his mighty heart.
Nor can the bull his awful front defend,
Or shake the murthering savages away.
Rapacious at the mother's throat they fly,
And tear the screaming infant from her breast.
The god like face of man avails him nought.
Even beauty, force divine! at whose bright glance
The generous lion stands in soften'd gaze,
Here bleeds, a hapless undistinguish'd prey.
But if, appris'd of the severe attack,
The country be shut up, lur'd by the scent,
On church-yards drear (inhuman to relate!)
The disappointed prowlers fall, and dig
The shrouded body from the grave; o'er which,
Mix'd with foul shades and frighted ghosts, they howl.

Thomson's Winter.

The wolf, unlike the dog, is an enemy to all society, and keeps no company even with those of his own species. When several wolves appear together, it is not a society of peace, but of war: it is attended with tumult and dreadful prowlings, and indicates an attack upon some large animal, as a stag, an ox, or a formidable mastiff. This military expedition is no sooner finished, than they separate, and each returns in silence to his solitude. There is even little intercourse between the males and females: They feel the mutual attractions of love but once a-year, and never remain long together. The females come in season in winter: many males follow the same female; and this association is more bloody than the former; for they growl, chase, fight, and tear one another, and often sacrifice him

CANIS. Plate CXVIII.




Thackara & Vallance Sculp.t

Canis. him that is preferred by the female. The female commonly flies a long time, fatigues her admirers, and retires, while they ſleep, with the moſt alert or moſt favourite male.

The ſeaſon of love continues only twelve or fifteen days; it commences with the oldeſt females; the young ones are not ſo early diſpoſed. The males have no marked period, but are equally ready at all times. They go from female to female, according as they are in a condition to receive them. They begin with the old females about the end of December, and finiſh with the young ones in the month of February or beginning of March. The time of geſtation is about three months and a half; and young whelps are found from the end of April to the month of July. The wolves copulate like the dogs, and have an oſſeous penis, ſurrounded with a ring, which ſwells and hinders them from ſeparating. When the females are about to bring forth, they ſearch for a concealed place in the inmoſt receſſes of the foreſt. After fixing on the ſpot, they make it ſmooth and plain for a conſiderable ſpace, by cutting and tearing up with their teeth all the brambles and bruſh-wood. They then bring great quantities of moſs, and prepare a commodious bed for their young, which are generally five or ſix, though ſometimes they bring forth ſeven, eight, and even nine, but never leſs than three. They come into the world blind, like the dogs; the mother ſuckles them ſome weeks, and ſoon learns them to eat fleſh, which ſhe prepares for them by tearing it into ſmall pieces. Some time after ſhe brings them field-mice, young hares, partridges, and living fowls. The young wolves begin by playing with theſe animals, and at laſt worry them; then the mother pulls off the feathers, tears them in pieces, and gives a part to each of her young. They never leave their den till the end of ſix weeks or two months. They then follow their mother, who leads them to drink in the hollow trunk of a tree, or in ſome neighbouring pool. She conducts them back to the den, or, when any danger is apprehended, obliges them to conceal themſelves elſewhere. Though, like other females, the ſhe-wolf is naturally more timid than the male; yet when her young are attacked, ſhe defends them with intrepidity; ſhe loſes all ſenſe of danger, and becomes perfectly furious. She never leaves them till their education is finiſhed, till they are ſo ſtrong as to need no aſſiſtance or protection, and have acquired talents fit for rapine, which generally happens in ten or twelve months after their firſt teeth (which commonly fall out in the firſt month) are replaced.

teaches

Wolves acquire their full growth at the end of two or three years, and live 15 or 20 years. When old, they turn whitiſh, and their teeth are much worn. When full, or fatigued, they ſleep, but more during the day than the night, and it is always a kind of ſlight ſlumber. They drink often; and, in the time of drought, when there is no water in the hollows, or in the trunks of old trees, they repair, ſeveral times in a day, to the brooks or rivulets. Though extremely voracious, if ſupplied with water, they can paſs four or five days without meat.

The wolf has great ſtrength, eſpecially in the anterior parts of the body, in the muſcles of the neck and jaws. He carries a ſheep in his mouth, and, at the ſame time, outruns the ſhepherds; ſo that he can only be ſtopped or deprived of his prey by dogs. His bite is cruel, and always more obſtinate in proportion to the ſmallneſs of the reſiſtance: for when an animal can defend itſelf, he is cautious and circumſpect. He never fights but from neceſſity, and not from motives of courage. When wounded with a ball, he cries; and yet, when diſpatching him with bludgeons, he complains not. When he falls into a ſnare, he is ſo overcome with terror, that he may be either killed or taken alive without reſiſtance: he allows himſelf to be chained, muzzled, and led where you pleaſe, without exhibiting the leaſt ſymptom of reſentment or diſcontent.

The ſenſes of the wolf are excellent, but particularly his ſenſe of ſmelling, which often extends farther than his eye. The odour of carrion ſtrikes him at the diſtance of more than a league. He likewiſe ſcents live animals very far, and hunts them a long time by following their tract. when he iſſues from the wood, he never loſes the wind. He ſtops upon the borders of the foreſt, ſmells on all ſides, and receives the emanations of living or dead animals brought to him from a diſtance by the wind. Though he prefers living to dead animals; yet he devours the moſt putrid carcaſes. He is fond of human fleſh; and, if ſtronger, he would perhaps eat no other. Wolves have been known to follow armies, to come in troops to the field of battle where bodies are careleſsly interred, to tear them up, and to devour them with an inſatiable avidity: And, when once accuſtomed to human fleſh, theſe wolves ever after attack men, prefer the ſhepherd to the flock, devour women, and carry off children. Wolves of this vicious diſpoſition are called *Loups garoux* by the French peaſants, who ſuppoſe them to be poſſeſſed with ſome evil ſpirits; and of this nature were the *were wulfs* of the old Saxons.

The wolf inhabits the continents of Europe, Aſia, Africa, and America, Kamtſchatka, and even as high as the arctic circle. The wolves of north America, are the ſmalleſt; and, when reclaimed, are the dogs of the natives: the wolves of Senegal the largeſt and fierceſt; they prey in company with the lion. Thoſe of the Cape are grey ſtriped with black; others are black.—They are found in Africa as low as the Cape; and are believed to inhabit New Holland, animals reſembling them having been ſeen there by the late circumnavigators. Dampier's people alſo ſaw ſome half-ſtarved animals in the ſame country, which they ſuppoſed to be wolves. In the eaſt, and particularly in Perſia, wolves are exhibited as ſpectacles to the people. When young, they are learned to dance, or rather to perform a kind of wreſtling with a number men. Chardin tells us, that a wolf, well educated in dancing, is ſold at 500 French crowns. This fact proves, that theſe animals, by time and reſtraint, are ſuſceptible of ſome kind of education. M. Buffon brought up ſeveral of them: "When young, or during their firſt year (he informs us), they are very docile, and even careſſing; and, if well fed, neither diſturb the poultry or any other animal: but, at the age of 18 months or two years, their natural ferocity appears, and they muſt be chained, to prevent them from running off and doing miſchief. I brought up one till the age of 18 or 19 months, in a court along with fowls, none of which he ever attacked; but for his firſt eſſay, he killed the whole in one night, with-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Canis.

out eating any of them. Another, having broken his chain, run off, after killing a dog with whom he had lived in great familiarity."

Whole countries are ſometimes obliged to arm, in order to deſtroy the wolves. Princes have particular equipages for this ſpecies of hunting, which is both uſeful and neceſſary. Hunters diſtinguiſh wolves into *young*, *old*, and *very old*. They know them by the tracts of their feet. The older the wolf, his feet is the larger. The ſhe-wolf's feet are longer and more ſlender; her heel is alſo ſmaller, and her toes thinner. A good blood-hound is neceſſary for hunting the wolf: and, when he falls into the ſcent, he muſt be coaxed and encouraged: for all dogs have an averſion from the wolf, and proceed with coldneſs in the chace. When the wolf is raiſed, the gre-hounds are let looſe in pairs, and one is kept for diſlodging him, if he gets under cover; the other dogs are led before as a reſerve. The firſt pair are let looſe after the wolf, and are ſupported by a man on horſe-back; then the ſecond pair are let looſe, at the diſtance of ſeven or eight hundred paces; and, laſtly, the third pair, when the other dogs begin to join and to teaze the wolf. The whole together ſoon reduce him to the laſt extremity; and the hunters complete the buſineſs by ſtabbing him with a dagger. The dogs have ſuch a reluctance to the wolf's fleſh, that it muſt be prepared and ſeaſoned before they will eat it. The wolf may alſo be hunted with beagles or hounds; but as he darts always ſtraight forward, and runs for a whole day without ſtopping, the chance is irkſome, unleſs the beagles be ſupported by grey-hounds, to teaze him, and give the hounds time to come up.

Wolves are now ſo rare in the populated parts of America, that the inhabitants leave their ſheep the whole night unguarded: yet the government of Pennſylvania and New-Jerſey did ſome years ago allow a reward of twenty ſhillings, and the laſt even thirty ſhillings for the killing of every wolf. Tradition informed them what a ſcourge thoſe animals had been to the colonies, ſo they wiſely determined to prevent the like evil. In their infant ſtate, wolves came down in multitudes from the mountains, often attracted by the ſmell of the corpſes of hundreds of Indians, who died of the ſmall-pox, brought among them by the Europeans: but the animals did not confine their inſults to the dead, but even devoured in their huts the ſick and dying ſavages.

Beſides being hunted, wolves are deſtroyed by pitfalls, traps, or poiſon. A peaſant in France who kills a wolf, carries its head from village to village, and collects ſome ſmall reward from the inhabitants: the Kirgis-Coſſacks take the wolves by the help of a large hawk called *berkut*, which is trained for the diverſion, and will faſten on them and tear out their eyes. Britain, a few centuries ago, was much infeſted by them. It was, as appears by Hollingſhed, very noxious to the flocks in Scotland in 1577; nor was it entirely extirpated till about 1680, when the laſt wolf fell by the hand of the famous Sir Ewen Cameron. We may therefore with confidence aſſert the non-exiſtence of theſe animals, notwithſtanding M. de Buffon maintains that the Engliſh pretend to the contrary. It has been a received opinion, that the other parts of Britain were in early times delivered from this peſt by the care of king Edgar. In England he attempted to effect it, by commuting the puniſhments of certain crimes into the acceptance of a certain number of wolves tongues from each criminal; and in Wales by converting the tax of gold and ſilver into an annual tax of 300 wolves heads. But, notwithſtanding theſe his endeavours, and the aſſertions of ſome authors, his ſcheme proved abortive. We find, that ſome centuries after the reign of that Saxon monarch, theſe animals were again increaſed to ſuch a degree as to become again the object of royal attention: accordingly Edward I. iſſued out his royal mandate to Peter Corbet to ſuperintend and aſſiſt in the deſtruction of them in the ſeveral counties of Glouceſter, Worceſter, Hereford, Salop, and Stafford; and in the adjacent county of Derby (as Cambden, p. 902, informs us), certain perſons at Wormhill held their lands by the duty of hunting and taking the wolves that infeſted the country, whence they were ſtyled *wolve-hunt*. To look back into the Saxon times, we find, that in Athelſtan's reign wolves abounded ſo in Yorkſhire, that a retreat was built at Flixton, in that county, "to defend paſſengers from the wolves, that they ſhould not be devoured by them:" and ſuch ravages did thoſe animals make during winter, particularly in January, when the cold was ſevereſt, that the Saxons diſtinguiſhed that month by the name of the *wolf-month*. They alſo called an outlaw *wolf's-head*, as being out of the protection of the law, proſcribed, and as liable to be killed as that deſtructive beaſt. Ireland was infeſted by wolves for many centuries after their extinction in England; for there are accounts of ſome being found there as late as the year 1710, the laſt preſentment for killing of wolves being made in the county of Cork about that time.

In many parts of Sweden the number of wolves has been conſiderably diminiſhed by placing poiſoned carcaſes in their way: but in other places they are found in great multitudes. Hunger ſometimes compels them to eat lichens: theſe vegetables were found in the body of one killed by a ſoldier; but it was ſo weak, that it could ſcarcely move. It probably had fed on the lichen vulpinus, which is a known poiſon to theſe animals. Madneſs, in certain years, is apt to ſeize the wolf. The conſequences are often very melancholy. Mad wolves will bite hogs and dogs, and the laſt again the human ſpecies. In a ſingle pariſh 14 perſons were victims to this dreadful malady. The ſymptoms are the ſame with thoſe attendant on the bite of a mad dog. Fury ſparkles in their eyes; a glutinous ſaliva diſtils from their mouths; they carry their tails low, and bite indifferently men and beaſts. It is remarkable that this diſeaſe happens in the depth of winter, ſo can never be attributed to the rage of the dog-days. Often towards ſpring, wolves get upon the ice of the ſea, to prey upon the young ſeals, which they catch aſleep: but this repaſt often proves fatal to them; for the ice, detached from the ſhore, carries them to a great diſtance from land, before they are ſenſible of it. In ſome years a large diſtrict is by this means delivered from theſe pernicious beaſts; which are heard howling in a moſt dreadful manner, far in the ſea. When wolves come to make their attack on cattle, they never fail attempting to frighten away the men by their cries; but the ſound of the horn makes them flying like lightning.

There is nothing valuable in the wolf but his ſkin which

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which makes a warm durable fur. His flesh is so bad, that it is rejected with abhorrence by all other quadrupeds; and no animal but a wolf will voluntarily eat a wolf. The smell of his breath is exceedingly offensive. As to appease hunger, he swallows indiscriminately every thing he can find, corrupted flesh, bones, hair, skins half tanned and covered with lime, he vomits frequently, and empties himself oftener than he fills. In fine, the wolf is consummately disagreeable; his aspect is base and savage, his voice dreadful, his odour insupportable, his disposition perverse, his manners ferocious; odious and destructive when living; and, when dead, he is perfectly useless.

Hyæna.

III. The HYÆNA has a straight jointed tail, with the hair of its neck erect, small naked ears, and four toes on each foot. It inhabits Asiatic Turkey, Syria, Persia, and Barbary. Like the jackal, it violates the repositories of the dead, and greedily devours the putrid contents of the grave; like it, preys on the herds and flocks; yet for want of other food, will eat the roots of plants, and the tender shoots of the palms: but, contrary to the nature of the former, it is an unsociable animal; is solitary, and inhabits the chasms of the rocks. The superstitious Arabs, when they kill one, carefully bury the head, lest it should be employed for magical purposes; as the neck was of old by the Thessalian sorceress.

*Viscera non lyncis, non diræ nodus hyænæ*
*Defuit.* Lucan, vi. 672.

The ancients were wild in their opinion of the hyæna; they believed that its neck consisted of one bone without any joint; that it changed its sex; imitated the human voice; had the power of charming the shepherds, and, as it were, rivetting them to the place they stood on: no wonder that an ignorant Arab should attribute preternatural powers to its remains. They are cruel, fierce, and untameable animals, of a most malevolent aspect; have a sort of obstinate courage, which will make them face stronger quadrupeds than themselves. Kæmpfer relates, that he saw one which had put two lions to flight, regarding them with the utmost coolness. Their voice is hoarse, a disagreeable mixture of growling and roaring.

Mr Pennant describes a variety of this species, undistinguished by former naturalists which he calls the *spotted hyæna*. It has a large and flat head; some long hairs above each eye; very long whiskers on each side of the nose; a short black mane, hair on the body short and smooth; ears short and a little pointed, their outside black, inside cinereous; face and upper part of the head black; body and limbs reddish brown, marked with distinct black round spots; the hind legs with black transverse bars; the tail short, black, and full of hair. It inhabits Guinea, Ethiopia, and the Cape: lives in holes in the earth, or cliffs of the rocks; preys by night; howls horribly; breaks into the folds, and kills two or three sheep; devours as much as it can, and carries away one for a future repast; will attack mankind, scrape open graves, and devour the dead. Bosman has given this creature the name of *jackal*; by which Buffon being misled, makes it synonymous with the common jackal. This hyæna is called the *tiger-wolf* by the colonists at the Cape, where it is a very common and formidable beast of prey. Of this animal, formerly but imperfectly known, the following account is given by Dr Sparmann in his voyage to the Cape.

Canis.

"The night, or the dusk of the evening only, is the time in which these animals seek their prey, after which they are used to roam about both separately and in flocks. But one of the most unfortunate properties of this creature is that it cannot keep its own counsel. The language of it cannot easily be taken down upon paper: however, with a view to make this species of wolf better known than it has been hitherto, I shall observe, that it is by means of a sound something like the following, *auuae*, and sometimes *ooao*, yelled out with a tone of despair (at the interval of some minutes between each howl), that nature obliges this, the most voracious animal in all Africa, to discover itself, just as it does the most venomous of all the American serpents, by the rattle in its tail, itself, to warn every one to avoid its mortal bite. This same rattle-snake would seem, in consequence of thus betraying its own designs, and of its great inactivity (to be as it were nature's step-child), if, according to many credible accounts, it had not the wondrous property of charming its prey by fixing its eye upon it. The like is affirmed also of the tiger-wolf. This creature, it is true, is obliged to give information against itself: but, on the other hand, is actually possessed of the peculiar gift of being enabled, in some measure, to imitate the cries of other animals; by which means this arch-deceiver is sometimes lucky enough to beguile and attract calves, foals, lambs, and other animals. Near some of the larger farms, where there is a great deal of cattle, this ravenous beast is to be found almost every night; and at the same time frequently from one hour to another betraying itself by its howlings, gives the dogs the alarm. The peasants assured me, that the cunning of the wolves was so great (adding, that the trick had now and then even succeeded with some of them), that a party of them, half flying and half defending themselves, would decoy the whole pack of dogs to follow them to the distance of a gun-shot or two from the farm, with a view to give an opportunity to the rest of the wolves to come out from their ambuscade, and, without meeting with the least resistance, carry off booty sufficient for themselves and their fugitive brethren. As the tiger-wolf, though a much larger and stronger animal, does not venture, without being driven to the utmost necessity, to measure its strength with the common dog, this is certainly an evident proof of its cowardice. Neither does this same voracious beast dare openly to attack oxen, cows, horses, or any of the large animals, while they make the least appearance as if they would defend themselves, or even as long as they do not betray any signs of fear. On the other hand, it has art enough to rush in upon them suddenly and unexpectedly, at the same time setting up a horrid and strange cry, so as to set them a running in consequence of the fright, that it may afterwards keep close to their heels with safety, till it has an opportunity with one bite or stroke to rip up the belly of its prey (even though it should be so large an animal as a draught ox), or else give it some dangerous bite, and so at one single bout make itself master of its antagonist. On this account the peasants are obliged to drive their cattle home every evening before it

Canis. it is dark, excepting the more considerable droves of draught oxen, which they let roam about day and night to seek their food unattended, by reason that they are used both to the country and the artifices of the wolves, and can therefore the easier depend upon and defend each other.

"Travellers, on the other hand, who are obliged to keep on in their journey, frequently suffer great losses by turning their cattle out at night; especially of the young ones, which are easiest scared. The Hottentots informed me that it was still within the memory of man, that the tiger-wolf was bold enough to steal upon them and molest them in their huts, particularly by carrying off their children. This, however, is now no longer the case; a circumstance, perhaps, proceeding from the introduction of fire-arms into the country, a circumstance, which in these latter times, has caused this, as well as other wild beasts, to stand in greater awe of man than it did formerly. I have heard the following story of the tiger-wolf mentioned, as being related in a certain treatise on the Cape, of which I now cannot exactly remember the title. The tale is laughable enough, though perhaps not quite so probable. 'At a feast near the Cape one night, a trumpeter who had got his fill was carried out of doors in order that he might cool himself, and get sober again. The scent of him soon drew thither a tiger-wolf, which threw him on his back, and dragged him along with him as a corpse, and consequently a fair prize, up towards Table-mountain. During this, however, our drunken musician waked, enough in his senses to know the danger of his situation, and to sound the alarm with his trumpet, which he carried fastened to his side. The wild beast, as may easily be supposed, was not less frightened in his turn.' Any other besides a trumpeter would, in such circumstances, have undoubtedly been no better than wolf's meat.

In the mean while it is certain, that these wolves are to be found almost every dark night about the shambles at the Cape, where they devour the offals of bones, skin, &c. which are thrown out there in great quantities, and drag away with them what they cannot eat. The inhabitants repay these good offices of the hyæna with a free and unlimited privilege of access and egress. The dogs too hereabouts, perfectly accustomed to their company, are said never to throw any impediment in their way; so that the beast, entertained and fed in the very heart of the town, has been seldom known to do any mischief there. It is likewise a well-known fact, that these wolves in different parts of Africa, exhibits different degrees of courage; this, however, may perhaps proceed from their being of different species in different parts.

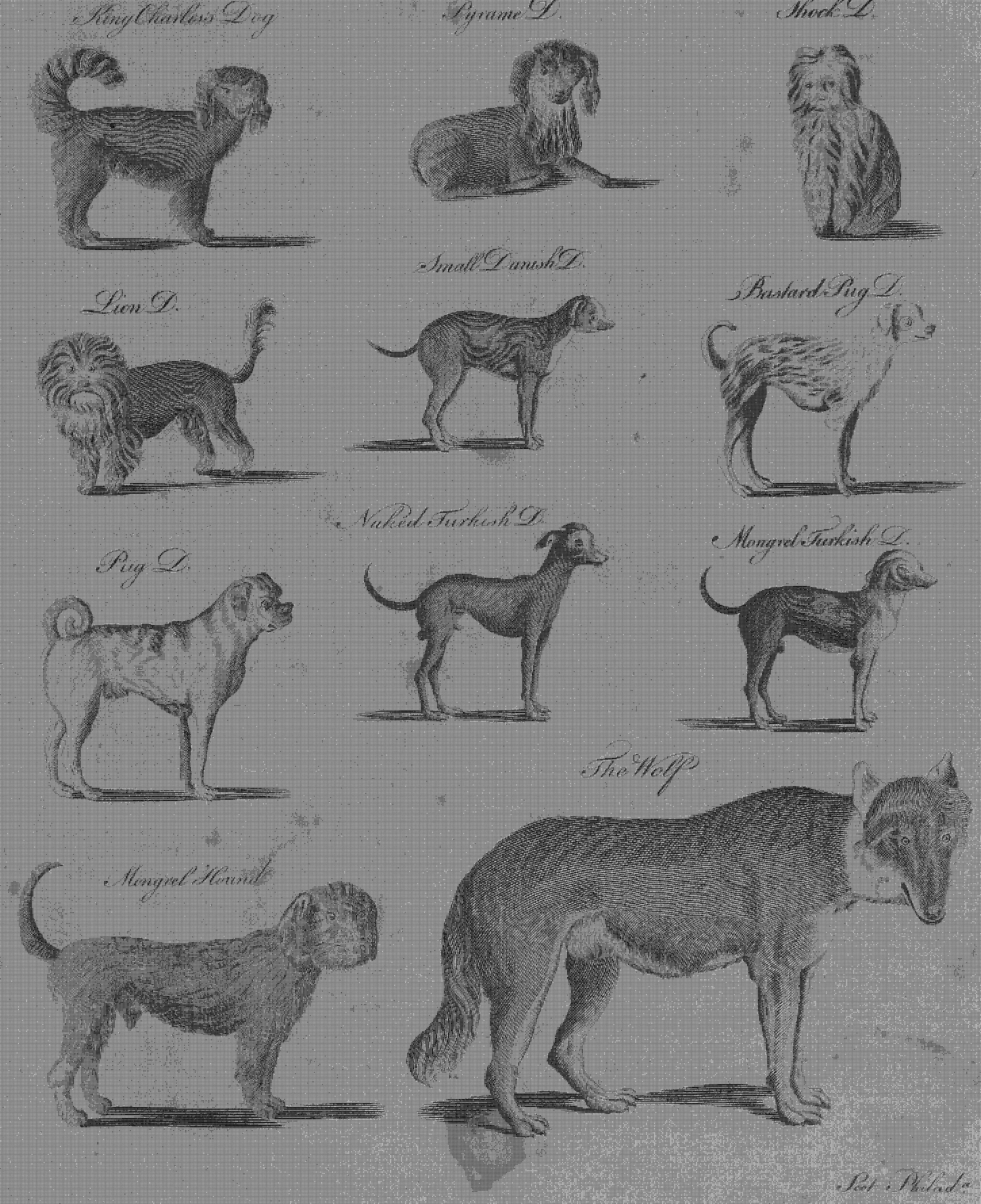
"Yet in this very greediness of the hyæna, and its disposition to consume every thing it can get at, the provident œconomy of nature is abundantly evinced. The flowery fields at the Cape would certainly soon become hideous and disfigured with carcases and skeletons, the relics of the great quantity of game of all sorts which graze and die there in succession, were not the tiger-wolf manifestly subservient to nature in the regulation of her police, by clearing her theatre from them; nay, I had almost said the wolf alone: for lions and tigers, for example, never eat bones, and are not very fond of carcases. These are serviceable in another way. They make the other animals vigilant and attentive to the functions for which nature has designed them; and besides answering several other intentions of Providence, they serve, in conjunction with mankind, to keep in a just equilibrium the increase of the animal kingdom; so that it may not exceed the supplies afforded it by the vegetable part of the creation, and by this means prevent the necessary renewal of the latter by seeds, &c. and thus by desolating it and laying it waste, in the end impoverish and destroy themselves, and die most wretched victims to want and hunger; so that, notwithstanding the immense quantities of game existing in this country, there are very seldom found any bones in the haunts they have left, and never after the tiger, lion, jackal, wild cat, and wild dog. These latter animals, that they may not encumber and litter the ground which nature has ordained them to clear, never go out of their dens and caverns when they find themselves sick and disabled; but there, oppressed with hunger and disease, await the transitory moment, when they must pay obedience to nature's last law."

The Mexicanus. IV. The MEXICANUS has a smooth, crooked tail. The body is ash-coloured, variegated with yellow spots. It is a native of Mexico, and is called the *mountain-cat* by Seba. It agrees with the European wolf in its manners, attacks cattle, and sometimes men.

The Fox. V. The VULPES, or Fox, has a straight tail, white at the point. His body is yellowish, or rather straw coloured; his ears are small and erect; his lips are whitish, and his forefeet black. From the base of the tail a strong scent is emitted, which to some people is very fragrant, and to others extremely disagreeable. The fox is a native of almost every quarter of the globe, and is if such a wild and savage nature that it is impossible fully to tame him. He is esteemed to be the most sagacious and the most crafty of all beasts of prey. The former quality he shows in his method of providing himself with an asylum, where he retires from pressing dangers, where he dwells, and where he brings up his young: and his craftiness is chiefly discovered by the schemes he falls upon in order to catch lambs, geese, hens, and all kinds of small birds. The fox fixes his abode on the border of the wood, in the neighbourhood of cottages: he listens to the crowing of the cocks and the cries of the poultry. He scents them at a distance; he chooses his time with judgment; he conceals his road as well as his design; he slips forward with caution, sometimes even trailing his body, and seldom makes a fruitless expedition. If he can leap the wall, or get in underneath, he ravages the court-yard, puts all to death, and then retires softly with his prey, which he either hides under the herbage, or carries off to his kennel. He returns in a few minutes for another, which he carries off, or conceals in the same manner, but in a different place. In this way he proceeds till the progress of the sun, or some movements perceived in the house, advertise him that it is time to suspend his operations, and to retire to his den. He plays the same game with the catchers of thrushes, wood-cocks, &c. He visits the nets and bird-lime very early in the morning, carries of successively the birds which are entangled, and lays them in different places, especially near the sides of high-ways, in the furrows, under the herbage or brushwood, where they sometimes

CANIS

Plate CXIX



Canis. lie two or three days; but he knows perfectly where to find them when he is in need. He hunts the young hares in the plains, seizes the old ones in their seats, never misses those which are wounded, digs out the rabbits in the warrens, discovers the nests of partridges and quails, seizes the mothers on the eggs, and destroys a vast quantity of game. The fox is exceedingly voracious; besides flesh of all kinds, he eats with equal avidity, eggs, milk, cheese, fruits, and particularly grapes. When the young hares and partridges fail him, he makes war against rats, field-mice, serpents, lizards, toads, &c. Of these he destroys vast numbers; and this is the only service he does to mankind. He is so fond of honey, that he attacks the wild bees, wasps, and hornets. They at first put him to flight by a thousand stings; but he retires only for the purpose of rolling himself on the ground to crush them; and he returns so often to the charge, that he obliges them to abandon the hive, which he soon uncovers, and devours both the honey and wax. In a word, he eats fishes, lobsters, grass hoppers, &c.

The fox is not easily, and never fully tamed: he languishes when deprived of liberty; and if kept too long in a domestic state, he dies of chagrin. Foxes produce but once a year; and the litter commonly consist of four or five, seldom six, and never less than three. When the female is full, she retires, and seldom goes out of her hole, where she prepares a bed for her young. She comes in season in the winter; and young foxes are found in the month of April. When she perceives that her retreat is discovered, and that her young have been disturbed, she carries them off one by one, and goes in search of another habitation. The young are brought forth blind; like the dogs, they grow 18 months or two years, and live 13 or 14 years.—The fox, as well as the congenerous wolf, will produce with the dog-kind, as noticed above.

The senses of the fox are equally good as those of the wolf; his sentiment is more delicate; and the organs of his voice are more pliant and perfect. The wolf sends forth only frightful howlings; but the fox barks, yelps, and utters a mournful cry like that of the peacock. He varies his tones according to the different sentiments with which he is affected: he has an accent peculiar to the chace, the tone of desire, of complaint, and of sorrow. He has another cry expressive of acute pain, which he utters only when he is shot, or has some of his members broken; for he never complains of any other wound, and, like the wolf, allows himself to be killed with a bludgeon without complaining; but he always defends himself to the last with great courage and bravery. His bite is obstinate and dangerous; and the severest blows will hardly make him quit his hold. His yelping is a species of barking, and consists of a quick succession of similar tones; at the end of which he generally raises his voice similar to the cry of the peacock. In winter, and particularly during frost and snow, he yelps perpetually; but, in summer, he is almost entirely silent, and, during this season, he casts his hair. He sleeps sound, and may be easily approached without weakening: he sleeps in a round form, like the dog; but, when he only reposes himself, he extends his hind legs, and lies on his belly. It is in this situation that he spies the birds along the hedges, and meditates schemes for their surprise. The fox flies when he hears the explosion of a gun, or smells gun-powder. He is exceedingly fond of grapes, and does much mischief in vineyards. Various methods are daily employed to destroy foxes: they are hunted with dogs; iron traps are frequently set at their holes; and their holes are sometimes smoked to make them run out, that they may the more readily fall into the snares, or be killed by dogs or fire-arms. Canis.

The chace of the fox requires less apparatus, and is more amusing, than that of the wolf. To the latter every dog has great reluctance: but all dogs hunt the fox spontaneously and with pleasure; for, though his own odour be strong, they often prefer him to the stag or the hare. He may be hunted with terriers, hounds, &c. Whenever he finds himself pursued, he runs to his hole; the terriers with crooked legs, or turnspits, go in with most ease. This mode answers very well when we want to carry off a whole litter of foxes, both mother and young. While the mother defends herself against the terriers, the hunters remove the earth above, and either kill or seize her alive. But, as the holes are often under rocks, the roots of trees, or sunk too deep in the ground, this method is frequently unsuccessful. The most certain and most common method of hunting foxes, is to begin with shutting up their holes, to place a man with a gun near the entrance, and then to search about with the dogs. When they fall in with him, he immediately makes for his hole; but when he comes up to it he is met with a discharge from the gun. If he escapes the shot, he runs with full speed, takes a large circuit, and returns again to the hole, where he is fired upon a second time; but, finding the entrance shut, he now endeavours to escape by darting straight forward, with the design of never revisiting his former habitation. He is then pursued by the hounds, whom he seldom fails to fatigue, because he purposely passes through the thickest parts of the forest or places of the most difficult access, where the dogs are hardly able to follow him; and, when he takes to the plains, he runs straight out, without stopping or doubling.

Of all animals the fox has the most significant eye, by which it expresses every passion of love, fear, hatred, &c. It is remarkably playful; but, like all savage creatures half reclaimed, will on the least offence bite those it is most familiar with. It is a great admirer of its bushy tail, with which it frequently amuses and exercises itself, by running in circles to catch it: and, in cold weather, wraps it round its nose. The smell of this animal is in general very strong, but that of the urine is remarkably fetid. This seems so offensive, even to itself, that it will take the trouble of digging a hole in the ground, stretching its body at full length over it; and there, after depositing its water, cover it over with the earth, as the cat does its dung. The smell is so obnoxious, that it has often proved the means of the fox's escape from the dogs; who have so strong an aversion at the filthy effluvia, as to avoid encountering the animal it came from. It is said that the fox makes use of its urine as an expedient to force the cleanly badger from its habitation: whether that is the means is rather doubtful; but that the fox makes use of the badger's hole is certain: not through want of ability to form its own retreat, but to save itself some trouble; for after the expulsion

of

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of the first inhabitant, the fox improves as well as enlarges it considerably, adding several chambers, and providently making several entrances to secure a retreat from every quarter. In warm weather, it will quit its habitation for the sake of basking in the sun, or to enjoy the free air; but then it rarely lies exposed, but chooses some thick brake, that it may rest secure from surprize. Crows, magpies, and other birds, who consider the fox as their common enemy, will often, by their notes of anger, point out its retreat.—The skin of this animal is furnished with a warm soft fur, which in many parts of Europe is used to make muffs and to line clothes. Vast numbers are taken in Le Vallais, and the Alpine parts of Switzerland. At Lausanne there are furriers who are in possession of betweeen 2000 and 3000 skins, all taken in one winter.

Of the fox there are several varieties, derived from colour; as,

1. The field-fox, or *alopex* of Linnæus, who makes it a distinct species; but it is every way the same with the common fox, except in the point of the tail, which is black.

2 The cross-fox, with a black mark passing transversely from shoulder to shoulder, with another along the back to the tail. It inhabits the coldest parts of Europe, Asia, and North-America: a valuable fur, thicker and softer than the common sort; great numbers of the skins are exported from Canada.

3. The black fox is the most cunning of any, and its skin the most valuable; a lining of it is, in Russia, esteemed preferable to the finest sables: a single skin will sell for 400 rubles. It inhabits the northern parts of Asia and North-America. The last is inferior in goodness.

4. The brant fox, as described by Gesner and Linnæus, is of a fiery redness; and called by the first *brand-fuchs*, by the last *brandraef*; it is scarce half the size of the common fox: the nose is black, and much sharper; the space round the ears ferruginous; the forehead, back, shoulders, thighs, and sides black mixed with red, ash-colour, and black; the belly yellowish; the tail black above, red beneath, and cinereous on its side. It is a native of Pennsylvania.

5. The corsac-fox, with upright ears, soft, downy hair; tail bushy; colour in summer pale tawney, in winter grey: the base and tip of the tail black; a small kind. It inhabits the desarts beyond the Yaik: lives in holes: howls and barks: is caught by the Kirgis Cassacks with falcons and grey-hounds; 40 or 50,000 are annually taken, and sold to the Russians, at the rate of 40 kopeiks, or 20 pence each: the former use their skins instead of money: great numbers are sent into Turkey.

6. There are three varieties of foxes found in the mountainous parts of Britain, which differ a little in form, but not in colour, from each other. They are distinguished in Wales by as many different names. The *milgi*, or *gre-hound-fox*, is the largest, tallest, and boldest; and will attack a grown sheep or wedder: the *mastiff-fox* is less, but more strongly built: the *corgi*, or *cur-fox* is the least; lurks about hedges, out-houses, &c. and is the most pernicious of the three to the feathered tribe. The first of these varieties has a white tag or tip to the tail; the last a black. When hunted, they never run directly forward, but make a great many doublings and turnings; and when in danger of being taken, they emit such a smell from their posteriors that the hunters can hardly endure it.

The arctic Fox.

VI. The LAGOPUS, or arctic fox, with a sharp nose; short rounded ears almost hid in the fur; long and soft hair, somewhat woolly; short legs; toes covered on all parts, like that of a common hare, with fur; tail shorter and more bushy than that of the common fox, of a bluish grey or ash colour, sometimes white: the young of the grey are black before they come to maturity: the hair much longer in winter than in summer, as is usual with animals of cold climates. It inhabits the countries bordering on the Frozen Sea; Kamschatka, the isles between it and America, and the opposite parts of America discovered in captain Bhering's expedition, 1741; is again found in Greenland, Iceland, Spitzbergen, Nova Zembla, and Lapland. It burrows underground, forms holes many feet in length, and strews the bottom with moss. In Greenland and Spitzbergen, it lives in the cliffs of rocks, not being able to burrow, by reason of the frost: two or three pair inhabit the same hole. They are in heat about Lady-day; and during that time, they continue in the open air, but afterwards take to their holes. They go with young nine weeks: like dogs, they continue united in copulation: they bark like that animal, for which reason the Russians call them *peszti*, or dogs. They have all the cunning of the common fox; prey on geese, ducks, and other water-fowl, before they can fly; on grouse of the country, on hares, and the eggs of birds; and in Greenland (through necessity) on berries, shell-fish, or any thing the sea flings up. But their principal food in the north of Asia and in Lapland is the leming, or Lapland marmot: those of the countries last mentioned are very migratory, pursuing the leming which is a wandering animal: sometimes these foxes will desert the country for three or four years, probably in pursuit of their prey; for it is well known that the migrations of the leming are very inconstant, it appearing in some countries only once in several years. The people of Jenesea suspect they go to the banks of the Oby. Their chief rendezvous is on the banks of the Frozen Sea, and the rivers that flow into it, where they are found in great troops. The Greenlanders take them either in pitfalls dug in the snow, and baited with the capelin fish; or in springs made with whalebone, laid over a hole made in the snow, strewed over at bottom with the same kind of fish; or in traps made like little huts, with flat stones, with a broad one by way of door, which falls down (by means of a string baited on the inside with a piece of flesh) whenever the fox enters and pulls at it. The Greenlanders preserve the skins for traffic; and in cases of necessity eat the flesh. They also make buttons of the skins; and split the tendons, and make use of them instead of thread. The blue furs are much more esteemed than the white.

The antarctic Fox.

VII. The INDICA, or antarctic fox (the *coyotl* of Fernandez, *the loup-renard* of Bougainville), has short pointed ears; irides hazel; head and body cinereous brown; hair more woolly than that of the common fox, resembling much that of the arctic; legs dashed with rust-colour; tail dusky, tipped with white; shorter and more bushy than that of the common fox, to which it is about one-third superior in size. It has much the habit of the wolf, in ears, tail, and strength of limbs.

The

Canis.

The French therefore call it *loup-renard*, or wolf-fox. It may be a wolf degenerated by climate. The largest are those of Senegal: the next are the European: those of North America are still smaller. The Mexican wolves, which Mr Pennant apprehends to be this species, are again less; and this, which inhabits the Falkland isles, near the extremity of South America, is dwindled to the size described. This is the only land animal of those distant isles: it has a fetid smell, and barks like a dog. It lives near the shores; kennels like a fox; and forms regular paths from bay to bay, probably for the conveniency of surprising the water-fowl, on which it lives. It is at times very meagre, from want of prey; and is extremely tame. The islands were probably stocked with those animals by means of masses of ice broken from the continent, and carried by the currents.

The grey-fox of Catesby.

VIII. The GREY-FOX of Catesby, &c. has a sharp nose; sharp, long, upright ears; legs long; colour grey, except a little redness about the ears.—It inhabits Carolina, and the warmer parts of North America: It differs from the arctic fox in form, and the nature of its dwelling; agrees with the common fox in the first, varies from it in the last: It never burrows, but lives in hollow trees; it gives no diversion to the sportsman; for after a mile's chace, it takes to its retreat; it has no strong smell; it feeds on poultry, birds, &c. These foxes are easily made tame; their skins, when in season, made use of for muffs.

The silver Fox of Lousiana.

IX. The SILVER FOX of Louisiana. It resembles the common fox in form, but has a most beautiful coat. The short hairs are of a deep brown; and over them spring long silvery hairs, which give the animal a very elegant appearance. They live in forests abounding in game, and never attempt the poultry which run at large. The woody eminences in Louisiana are every where pierced with their holes.

The Barbary Fox.

X. The BARBARY FOX, (*le Chacal*, Buff.) or jackaladive, has a long and slender nose, sharp upright ears, long bushy tail: colour, a very pale brown; space above and below the eyes, black; from behind each ear, there is a black line, which soon divides into two, which extend to the lower part of the neck; and the tail is surrounded with three broad rings. This species is of the size of the common fox, but the limbs are shorter, and the nose is more slender.—M. de Buffon informs us, that Mr Bruce told him this animal was common in Barbary, where it was called *thaleb*. But Mr Pennant observes, that Mr Bruce should have given it a more distinguishing name; for *thaleb*, or *taaleb*, is no more than the Arabic name for the common fox, which is also frequent in that country.

The Jackal.

XI. The AUREUS, Schakal, or Jackal, as described by Mr Pennant, has yellowish brown irides; ears erect, formed like those of a fox, but shorter and less pointed: hairy and white within; brown without, tinged with dusky; head shorter than that of a fox, and nose blunter: lips black, and somewhat loose: neck and body very much resembling those of that animal, but the body more compressed: the legs have the same resemblance, but are longer: tail thickest in the middle, tapering to the point: five toes on the fore-feet; the inner toe very short, and placed high: four toes on the hind-feet: all covered with hair even to the claws. The hairs are much stiffer than those of a fox, but scarcely so stiff as those of a wolf; short about the nose; on the back, three inches long; on the belly shorter. Those at the end of the tail four inches long. Colour of the upper part of the body a dirty tawny; on the back, mixed with black: lower part of the body of a yellowish white: tail tipt with black; the rest of the same colour with the back: the legs of an unmixed tawny brown; the fore legs marked (but not always) with a black spot on the knees; but on no part are those vivid colours which could merit the title of *golden*, bestowed on it by Kæmpfer.—The length of this animal from the nose to the root of the tail is little more than twenty-nine inches English: the tail, to the ends of the hairs, ten three quarters; the tip reaching to the top of the hind legs: the height, from the space between the shoulders to the ground, rather more than eighteen inches and a half; the hind parts a little higher.—This species inhabits all the hot and temperate parts of Asia, India, Persia, Arabia, Great Tartary, and about Mount Caucasus, Syria, and the Holyland. It is found in most parts of Africa, from Barbary to the Cape of Good Hope.

Professor Gueldenstaedt*, the able describer of this long-lost animal, remarks, that the cæcum entirely agrees in form with that of a dog, and differs from that of the wolf and fox. And Mr Pennant observes, that there is the same agreement in the teeth with those of a dog; and the same variation in them from those of the two other animals. These circumstances strengthen the opinion entertained by some writers, that the dogs of the old world did derive their origin from one or other of them. The jackals have indeed so much the nature of dogs, as to give reasonable cause to imagine that they are at least the *chief* stock from which is sprung the various races of those domestic animals. When taken young, they grow instantly tame; attach themselves to mankind; wag their tails; love to be stroked; distinguish their masters from others; will come on being called by the name given to them; will leap on the table, being encouraged to it: they drink, lapping; and make water sideways, with their leg held up. Their dung is hard: *odorat anum alterius, cohæret copula junctus.* When they see dogs, instead of flying, they seek them, and play with them. They will eat bread eagerly; notwithstanding they are in a wild state carnivorous. They have a great resemblance to some of the Calmuc dogs, which perhaps were but a few descents removed from the wild kinds. Our dogs are probably derived from those reclaimed in the first ages of the world; altered by numberless accidents into the many varieties which now appear among us.

*Nov. Com. Petrop. xx. 449.

The wild schakals go in packs of 40, 50, and even two hundred, and hunt like hounds in full cry from evening to morning. They destroy flocks and poultry, but in a less degree than the wolf or fox: ravage the streets of villages and gardens near towns, and will even destroy children, if left unprotected. They will enter stables and outhouses, and devour skins, or any thing made of that material. They will familiarly enter a tent, and steal whatsoever they can find from the sleeping traveller. In default of living prey, they will feed on roots and fruits; and even on the most infected carrion: they will greedily disinter the dead, and devour the putrid carcases; for which reason, in many countries the graves are made of a great depth. They attend

tend caravans, and follow armies, in hopes that death will provide them a banquet.

Their voice naturally is a howl. Barking, Mr Pennant observes, is latently inherent; and in their state of nature seldom exerted: but its different modifications are adventitious, and expressive of the new passions and affections gained by a domestic state. Their howlings and clamours in the night are dreadful, and so loud that people can scarcely hear one another speak. Dellon says, their voice is like the cries of a great many children of different ages mixed together: when one begins to howl, the whole pack join in the cry. Kæmpfer says, that every now and then a sort of bark is intermixed; which confirms what is above asserted by Mr Pennant. Dellon agrees in the account of their being tamed, and entertained as domestic animals. During day they are silent. They dig burrows in the earth, in which they lie all day, and come out at night to range for prey: they hunt by the nose, and are very quick of scent. The females breed only once a year; and go with young only four weeks; they bring from six to eight at a time. Both Mr Gueldenstaedt and Mr Bell contradict the opinion of their being very fierce animals.

This animal is vulgarly called the *Lion's Provider*, from an opinion that it rouzes the prey for that bad-nosed quadruped. The fact is, every creature in the forest is set in motion by the fearful cries of the jackals; the lion, and other beasts of rapine, by a sort of instinct, attend to the chace, and seize such timid animals as betake themselves to flight at the noise of this nightly pack. The jackal is described by Oppian, under the name of Λυκος Ξανθος, or *yellow wolf*; who mentions its horrible howl. It may, as M. de Buffon conjectures, be the Θως of Aristotle, who mentions it with the wolf, and says that it has the same internal structure as the wolf, which is common with congenerous animals. The Theos of Pliny may also be a variety of the same animal; for his account of it agrees with the modern history of the schakal, except in the last article: "Thoes, Luporum id genus est procerius longitudine, brevitate crurum dissimile, velox saltu, venatu vivens, innocuum homini;" lib. viii. c. 34.

The Mesomelas. XII. The MESOMELAS, or *Capesch* of Schreber, the *tenlie* or *kenlie* of the Hottentots, has erect yellowish brown ears, mixed with a few scattered black hairs: the head is of a yellowish brown, mixed with black and white, growing darker towards the hind part: the sides are of a light brown, varied with dusky hairs: the body and also the back part of the legs are of a yellowish brown, lightest on the body: the throat, breast, and belly white. On the neck, shoulders, and back, is a bed of a black; broad on the shoulders, and growing narrower to the tail: when the hairs are smooth, the part on the neck seems barred with white; that on the shoulders with white conoid marks, one within the other, the end pointing to the back: when the hairs are ruffled, these marks vanish, or grow less distinct, and a hoaryness appears in their stead. The tail is bushy, of a yellowish brown; marked on the upper part with a longitudinal stripe of black, and towards the end encircled with two rings of black, and is tipt with white. In length, the animal is two feet three quarters, to the origin of the tail: the tail is one foot. This species inhabits the countries about the Cape of Good Hope, and probably is found as high as the line.



The Thous. XIII. The THOUS has a smooth crooked tail: the upper part of its body is grey, and its belly white. It is about the size of a large cat; and, according to Linnæus, is found at Surinam; it is mentioned by no other naturalist.

The Zerda. XIV. The ZERDA. This animal has a very pointed visage; large bright black eyes; very large ears, of a bright rose-colour, internally lined with long hairs; the orifice so small as not to be visible, probably covered with a valve or membrane: the legs and feet are like those of a dog; the tail is taper: colour between a straw and pale brown. Length from nose to tail, ten inches; ears, three inches and a half long; tail, six: height, not five. It inhabits the vast desart of Saara, which extends beyond mount Atlas: It burrows in the sandy ground, which shows the necessity of the valves to the ears; and is so excessively swift, that it is very rarely taken alive. It feeds on insects, especially locusts: sits on its rump: is very vigilant: barks like a dog, but much shriller, and that chiefly in the night: never is observed to be sportive. We are indebted to Mr Eric Skioldebrand, the late Swedish consul at Algiers, for our knowledge of this singular animal. He never could procure but one alive, which escaped before he examined his teeth: the genus is very uncertain: the form of its head and legs, and some of its manners, determined Mr Pennant to rank it in this genus. That which was in possession of Mr Skioldebrand fed freely from the hand, and would eat bread or boiled meat. Buffon has given a figure of this animal: but from the authority of Mr Bruce ascribes to it a different place, and different manners. He says that it is found to the south of the Palus Tritonides, in Libya; that it has something of the nature of the hare, and something of the squirrel; and that it lives on the palm-trees, and feeds on the fruits.

CANIS *Major*, the great dog in astronomy, a constellation of the southern hemisphere, below Orion's feet, though somewhat to the westward of him; whose stars Ptolemy makes 29; Tycho observed only 13; Hevelius 21; in the Britannic catalogue they are 31.

CANIS *Minor*, the little dog, in astronomy, a constellation of the northern hemisphere; called also by the Greeks, *Procyon*, and by the Latins *Antecanis* and *Canicula*. The stars in the constellation canis minor, are in Ptolemy's catalogue 2; in Tycho's, 5; in Hevelius's, 13; and in the British catalogue, 14.

CANISIUS, (Henry) a native of Nimeguen, and one of the most learned men of his time, was professor of canon law at Ingolstadt; and wrote a great number of books; the principal of which are, 1. *Summa Juris Canonici*. 2. *Antiquæ lectionis*, a very valuable work. He died in 1609.

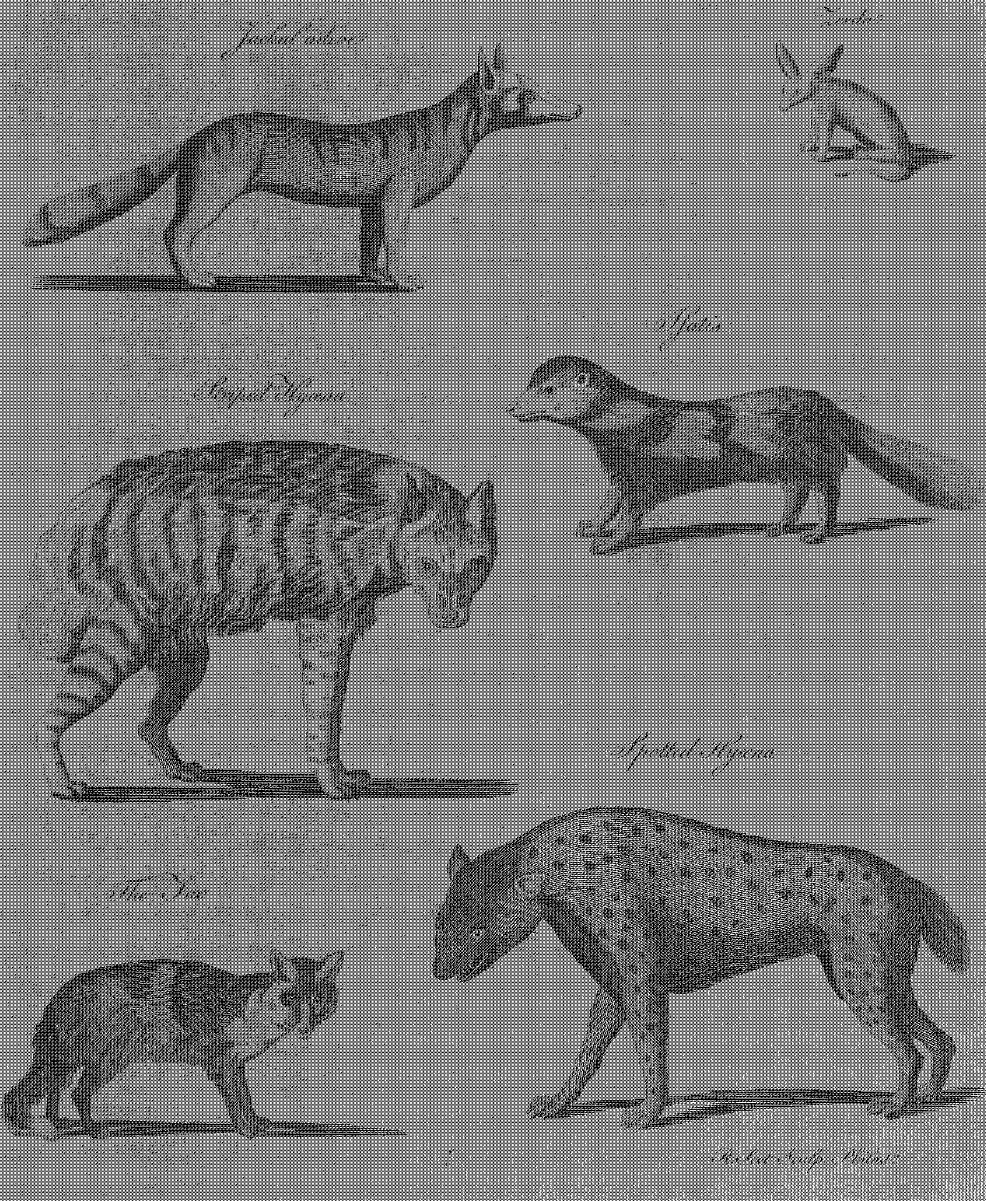
CANITZ, (The baron of) a German poet and statesman, was of an ancient and illustrious family in Brandenburg, and born at Berlin in 1564, five months after his father's death. After his early studies, he travelled to France, Italy, Holland, and England; and upon his return to his country, was charged with important negociations by Frederic II. Frederic III. employed him also. Canitz united the statesman with the poet; and was conversant in many languages, dead



as

CANIS

Plate CXX




R. Scot Sculp. Philad.

Canker | Cannabis.

as well as living. His German poems were published for the tenth time, 1750, in 8vo. He is said to have taken Horace for his model, and to have written purely and delicately. But he did not content himself with barely cultivating the fine arts in himself; he gave all the encouragement he could to them in others. He died at Berlin, in 1699, privy counsellor of state, aged 45.

CANKER, a disease incident to trees, proceeding chiefly from the nature of the soil. It makes the bark rot and fall. If the canker be in a bough, cut it off; in a large bough, at some distance from the stem; in a small one, close to it: but for over-hot strong ground, the ground is to be cooled about the roots with pond-mud and cow-dung.

CANKER, among farriers. See FARRIERY, § xliv. 2.

CANNA, in botany: A genus of the monogynia order, belonging to the monandria class of plants; and in the natural method ranking under the eighth order, *Scitamineæ*. The corolla is erect, and divided into six parts, with a distinct lip bipartite and rolled back; the style lanceolate, and growing to the corolla; the calyx is triphyllous.

*Species*. 1. The indica, or common broad-leaved flowering cane, is a native of both Indies; the inhabitants of the British islands in America call it *Indian shot*, from the roundness and hardness of the seeds. It hath a thick, fleshy, tuberous root, which divides into many irregular knobs; it sends out many large oval leaves, without order. At their first appearance the leaves are like a twisted horn; but afterwards expand, and are near a foot long, and five inches broad in the middle; lessening gradually to both ends, and terminated in a point. The stalks are herbaceous, rising four feet high, and are encompassed by the broad leafy foot-stalks of the leaves; at the upper part of the stalk the flowers are produced in loose spikes, each being at first covered with a leafy hood, and turns to a brown colour. The flowers are succeeded by a fruit or capsule, oblong, rough, and crowned with the three-cornered empalement of the flower which remains. When the fruit is ripe, the capsule opens lengthwise into three cells, filled with round, shining, hard, and black seeds. 2. The latifolia, with a pale red flower, is a native of Carolina, and some other northern parts of America. 3. The glauca, with a very large flower, is a native of South America. 4. The lutea, with obtuse oval leaves, is less common in America than the other sorts. 5. The coccinea, hath larger leaves than any of the other species, and the stalks rise much higher. The flowers are produced in large spikes; and are of a bright crimson, or rather scarlet colour.

*Culture*. These plants must always be kept in pots of rich earth, to be moved to shelter in winter. They are propagated by seeds sown on a hot-bed, in the spring; and in summer, when the plants are a little advanced in growth, prick them separately in small pots of rich earth, plunging them also in the hot-bed, giving shade, water, and fresh air; to which last harden them by degrees, till they bear it fully. In October they must be removed into a very good stove or green house.

CANNABIS, in botany: A genus of the pentandria order, belonging to the dioecia class of plants; and in the natural method ranking under the 53d order, *Scabridæ*. The calyx of the male is quinquepartite, with no corolla. In the female the calyx is monophyllous, entire, and gaping at the side; there is no corolla, but two styles; the fruit is a nut, bivalved, within the closed calyx. Of this there is but one species, viz. the sativa. This is propagated in the rich fenny parts of England in great quantities, for its bark, which is useful for cordage, cloth, &c. and the seeds abound with oil. Hemp is always sown on a deep, moist, rich, soil, such as is found in Holland, Lincolnshire, the fens of the island of Ely, where it is cultivated to great advantage, as it might be in many other parts of England where there is a soil of the same kind; but it will not thrive on clayey or stiff cold land. The ground on which hemp is designed to be sown, should be well ploughed, and made very fine by harrowing. About the middle of April the seed may be sown; three bushels is the usual allowance for an acre, but two are sufficient. In the choice of the seed, the heaviest and brightest coloured should be preferred; and particular care should be had to the kernel of the seed. For the greater certainty in this matter, some of the seeds should be cracked, to see whether they have the germ or future plant perfect: for, in some places, the male plants are drawn out too soon from the female, i. e. before they have impregnated the female plants with the farina; in which case, though the seeds produced by these females may seem fair to the eye, yet they will not grow,* according to the doctrine of Linnæus. When the plants are come up, they should be hoed out in the same manner as is practised for turnips, leaving them two feet apart; observe also to cut down all the weeds, which, if well performed, and in dry weather, will destroy them. This crop, however, will require a second hoeing, in about six weeks after the first; and, if this is well performed, the crop will require no further care. The first season for pulling hemp is usually about the middle of August, when they begin to pull what they call the *fimble hemp*, being that which is composed of the male plants; but it would be the much better method to defer this for a fortnight or three weeks longer, until those male plants have fully shed their farina or dust, without which the seeds will prove only empty husks. These male plants decay soon after they have shed their farina. The second pulling is a little after Michaelmas, when the seeds are ripe. This is usually called *karle hemp*, and consists of the female plants which were left. This karle hemp is bound in bundles of a yard compass, according to statute measure, which are laid in the sun for a few days to dry; and then it is stacked up, or housed, to keep it dry till the seed can be threshed out. An acre of hemp, on a rich soil, will produce near three quarters of seed, which, together with the unwrought hemp, is worth from six to eight pounds. Hemp is esteemed very effectual for destroying weeds: but this it accomplishes by impoverishing the ground, and thus robbing them of their nourishment; so that a crop of it must not be repeated on the same spot.

* See *Botany*, sect. iii.

Some seeds of a large kind of hemp growing in China were lately sent by the English East India Company to the Society for the encouragement of Arts, Manufactures, and Commerce, who distributed them to the members and other gentlemen who appeared likely to cultivate them; and from experiments made in conse-



quence,

quence, the plant has been found to ſucceed perfectly in England. The firſt trials were rather unpromiſing, the hemp produced from the foreign ſeeds proving of very little value. But the Reverend Dr Hinton of Northwold, who made the above trial in 1786, having accidentally ſaved ſome ripe ſeeds of that crop, ſowed them in May 1787 on a ſpot of good land. They came up well, and attained as much perfection as ordinary hemp. The produce, when dreſſed, weighed at the rate of 95 ſtone 7 pounds and 12 ounces per acre, (being above 20 ſtone more, he ſays, than the uſual crops of hemp in that neighbourhood); and at the rate of three buſhels two pecks and half a pint of ſeed per acre were ſaved. Dr Hinton ſuppoſes that the ſeeds brough from China failed principally, if not entirely, by having been two years old, at which age hempſeed ſeldom vegetates. Now that it is found to ripen, freſh ſeeds can always be obtained. It will yet, however, require a few years to determine whether this ſpecies will continue to retain its great ſize, or will degenerate and become the common hemp of Europe.

From the leaves of hemp pounded and boiled in water, the natives of the Eaſt Indies prepare an intoxicating liquor of which they are very fond. The plant, when freſh, has a rank narcotic ſmell; the water in which the ſtalks are ſoaked, in order to ſeparate the tough rind for mechanic uſes, is ſaid to be violently poiſonous, and to produce its effects almoſt as ſoon as drank. The ſeeds alſo have ſome ſmell of the herb, and their taſte is unctuous and ſweetiſh: they are recommended, boiled in milk, or triturated with water into an emulſion, againſt coughs, heat of urine, and the like. They are alſo ſaid to be uſeful in incontinence of urine, and for reſtraining venereal appetites; but experience does not warrant their having any virtues of that kind.

CANNÆ, (anc. geog.) a town of Apulia in the Adriatic, at the mouth of the river Aufidus, rendered famous by a terrible overthrow which the Romans here received from the Carthaginians under Hannibal. The Roman conſuls Æmilius Paulus and Terentius Varro, being authorized by the ſenate to quit the defenſive plan, and ſtake the fortunes of the republic on the chance of a battle, marched from Canuſium, and encamped a few miles eaſt, in two unequal diviſions, with the Aufidus between them. In this poſition they meant to wait for an opportunity of engaging to advantage; but Hannibal, whoſe critical ſituation in a deſolated country, without refuge or allies, could admit of no delay, found means to inflame the vanity of Varro by ſome trivial advantages in ſkirmiſhes between the light horſe. The Roman, elated with this ſucceſs, determined to bring matters to a ſpeedy concluſion; but, finding the ground on the ſouth ſide too confined for the operation of ſo large an army, croſſed the river; and Varro, reſting his right wing upon the Aufidus, drew out his forces in the plain. Hannibal, whoſe head quarters were at Cannæ, no ſooner perceived the enemy in motion, than he forded the water below, and marſhalled his troops in a line oppoſite to that of his adverſaries.

The Romans were vaſtly ſuperior in number to the Carthaginians; but the latter were ſuperior in cavalry. The army of the former, conſiſting of 87,000 men, was drawn up in the uſual manner; the *haſtati* in the firſt line, the *principes* in the ſecond, and the *triarii* in the third. The cavalry were poſted on the wings. On the right, the Roman knights flanked the legionaries; in the left, the cavalry of the allies covered their own infantry. The two conſuls commanded the two wings, Emilius the right, and Terentius the left; and the two proconſuls Servilius and Attilius the main body. On the other hand, Hannibal, whoſe army conſiſted of 40,000 foot and 10,000 horſe, placed his Gauliſh and Spaniſh cavalry in his left wing, to face the Roman knights; and the Numidian horſe in his right, over againſt the cavalry of the allies of Rome. As to his infantry, he divided the African battalions into two bodies; one of which he poſted near the Gauliſh and Spaniſh horſe, the other near the Numidian. Between theſe two bodies were placed on one ſide the Gauliſh, on the other the Spaniſh infantry, drawn up in ſuch a manner as to form an obtuſe angle projecting a conſiderable way beyond the two wings. Behind this line he drew up a ſecond which had no projection. Aſdrubal commanded the left wing; Maherbal the right; and Hannibal himſelf, with his brother Mago, the main body. He had alſo taken care to poſt himſelf in ſuch a manner that the wind *Vulturnus*, which riſes at certain ſtated times, ſhould blow directly in the faces of the Romans during the fight, and cover them with duſt. The onſet was begun by the light-armed infantry; the Romans diſcharging their javelins, and the *baleares* their ſtones, with pretty equal ſucceſs; nevertheleſs, the conſul Emilius was wounded. Then the Roman cavalry in the right wing advanced againſt the Gauliſh and Spaniſh in Hannibal's left. As they were ſhut in by the river Aufidus on one ſide, and by their infantry on the other, they did not fight, as uſual, by charging and wheeling off, and then returning to the change; but continued fighting each man againſt his adverſary, till one of them was killed or retired. After they had made prodigious efforts on both ſides to overbear each other, they all on a ſudden diſmounted, and fought on foot with great fury. In this attack the Gauls and Spaniards ſoon prevailed; put the Romans to the rout; and, purſuing them along the river, ſtrewed the ground with their dead bodies, Aſdrubal giving no quarter. This action was ſcarce over, when the infantry on both ſides advanced. The Romans firſt fell upon the Spaniards and Gauls, who, as already obſerved, formed a kind of triangle projecting beyond the two wings. Theſe gave ground, and, purſuant to Hannibal's directions, ſunk into the void ſpace in their rear; by which means they inſenſibly brought the Romans into the centre of the African infantry, and then the fugitives rallying, attacked them in front, while the Africans charged them in both flanks. The Romans, being by this artful retreat drawn into the ſnare and ſurrounded, no longer kept their ranks, but formed ſeveral platoons in order to face every way. Emilius, who was on the right wing, ſeeing the danger of the main body, at the head of his legionaries acted the part both of a ſoldier and general, penetrating into the heart of the enemy's battalions, and cutting great numbers of them in pieces. All the Roman cavalry that were left, attended the brave conſul on foot; and, encouraged by his example, fought like men in deſpair. But, in the mean time, Aſdrubal, at the head of a detachment of Gauliſh and Spaniſh

Cannæ. Spanish infantry brought from the centre, attacked Æmilius's legionaries with such fury, that they were forced to give ground and fly: the consul being all covered with wounds, was at last killed by some of the enemy who did not know him. In the main body, the Romans, though invested on all sides, continued to sell their lives dear; fighting in platoons, and making a great slaughter of the enemy. But being at length overpowered, and disheartened by the death of the two proconsuls Servilius and Attilius who headed them, they dispersed and fled, some to the right, and others to the left, as they could find opportunity; but the Numidian horse cut most of them in pieces: the whole plain was covered with heaps of dead bodies, insomuch that Hannibal himself, thinking the butchery too terrible, ordered his men to put a stop to it.—There is a great disagreement among authors as to the number of Romans killed and taken at the battle of Cannæ. According to Livy, the republic lost 50,000 men, including the auxiliaries. According to Polybius, of 6000 Roman horse, only 70 escaped to Venusia with Terentius Varro and 300 of the auxiliary horse. As to the infantry, that writer tells us, that 70,000 of the Roman foot died on the field of battle fighting like brave men; and that 13,000 were made prisoners. According to Dionysius of Halicarnassus, of 6000 horse, only 370 escaped the general slaughter, and of 80,000 foot, 3000 only were left. The most moderate computation makes the number of Romans killed to amount to 45,000. The scene of action is marked out to posterity, by the name of *Pezzo di Sangue*, "Field of Blood."

These plains have more than once, since the Punic war, afforded room for men to accomplish their mutual destruction. Melo of Bari, after raising the standard of revolt against the Greek emperors, and defeating their generals in several engagements, was at last routed here in 1019, by the Catapan Bolanus. Out of two hundred and fifty Norman adventurers, the flower of Melo's army, only ten escaped the slaughter of the day. In 1201, the archbishop of Palermo and his rebellious associates, who had taken advantage of the nonage of Frederic of Swabia, were cut to pieces at Cannæ by Walter de Brienne, sent by the pope to defend the young king's dominions.

The traces of the town of Cannæ are very faint, consisting of fragments of altars, cornices, gates, walls, vaults and under-ground granaries. It was destroyed the year before the battle; but being rebuilt, became an episcopal see in the infancy of Christianity. It was again ruined in the sixth century, but seems to have subsisted in an humble state many ages later; for we read of its contending with Barletta for the territory, which till then had been enjoyed in common by them; and in 1284, Charles I. issued an edict for dividing the lands to prevent all future litigation. The prosperity of the towns along the coast, which increased in wealth and population by embarkations for the Crusadoes and by traffic, proved the annihilation of the great inland cities; and Cannæ was probably abandoned entirely before the end of the thirteenth century.

CANNEQUINS, in commerce, white cotton cloths brought from the East-Indies. They are a proper commodity for trading on the coast of Guinea, particularly about the rivers Senega and Gambia. These linens are folded square-wise, and are about eight ells long.

Cannel Coal || Cannonade

CANNEL COAL. See AMPELITES.

CANNES, a town of France in Provence, and in the viguerie of Grasse, seated on the coast of the Mediterranean sea, with a harbour and a castle. E. Long. 7. 7. N. Lat. 43. 34.

CANNIBAL, a modern term for an anthropophagus or man-eater, more especially in the West-Indies. See ANTHROPOHAGI.

CANNON, a military engine for throwing balls, &c. by the help of GUNPOWDER.

The invention of brass cannon is by Laney ascribed to J. Owen: he says, that they were first known in England in the year 1535; but yet acknowledges, that, in 1346, there were four pieces of cannon in the English army at the battle of Cressy, and that these were the first that were known in France. And Mezeray relates, that king Edward, by five or six pieces of cannon struck terror into the French army, it being the first time they had seen any of these thundering machines; though others affirm that cannon were known also in France at the same time; but that the French king, in his hurry to attack the English, and in confidence of victory, left all his cannon behind him as useless incumbrances (See ARTILLERY). The Germans carry the invention further back, and attribute it to Albertus Magnus, a Dominican monk, about the year 1250. Vossius rejects all these opinions, and finds cannon in China almost 1700 years ago. According to him they were mounted by the emperor Kitey in the year of Christ 85. For further particulars of their history, &c. see GUN and GUNNERY.

For the casting of cannon, see FOUNDERY. For their different parts, proportions, management, operation, and effects, see GUNNERY.

CANNON, with letter-founders and printers, the name of the lagest size of letters they use.

CANNONADE, the application of artillery to the purposes of war, or the direction of its efforts against some distant object intended to be seized or destroyed, as a ship, battery, or fortress. See GUNNERY.

Since a large ship of war may be considered as a combination of floating batteries, it is evident that the efforts of her artillery must be greatly superior to those of a fortress on the sea-coast; that is to say, in general; because, on some particular occasions, her situation may be extremely dangerous, and her cannonading ineffectual. Her superiority consists in several circumstances, as the power of bringing her different batteries to converge to one point; of shifting the line of her attack so as to do the greatest possible execution against the enemy, or to lie where she will be the least exposed to his shot; and chiefly because, by employing a much greater number of cannon against a fort than it can possibly return, the impression of her artillery against stone-walls soon becomes decisive and irresistible. Besides these advantages in the attack, she is also greatly superior in point of defence: because the cannon-shot, passing with rapidity through her sides, seldom do any execution out of the line of their flight, or occasion much mischief by their splinters; whereas they very soon shatter and destroy the faces of a parapet, and produce incredible havoc among the men by the fragments of the stones, &c. A ship may also retreat

treat when ſhe finds it too dangerous to remain longer expoſed to the enemy's fire, or when her own fire cannot produce the deſired effect. Finally, the fluctuating ſituation of a ſhip, and of the element on which ſhe reſts, renders the effects of bombs very uncertain, and altogether deſtroys the effects of the *ricochet*, or rolling and bounding ſhot, which is ſo pernicious, and deſtructive in a fortreſs or land engagement. The chief inconveniency to which a ſhip is expoſed, on the contrary, is, that the low-laid cannon in a fort near the brink of the ſea, may ſtrike her repeatedly on or under the ſurface of the water, ſo as to ſink her before her cannonade can have any conſiderable efficacy.

CANNULA, in ſurgery, a tube made of different metals, principally of ſilver and lead, but ſometimes of iron.

They are introduced into hollow ulcers, in order to facilitate a diſcharge of pus or any other ſubſtance; or into wounds, either accidental or artificial, of the large cavities, as the thorax or abdomen: they are uſed in the operation of bronchotomy; and, by ſome, after cutting for the ſtone, as a drain for urine.

Other cannulas are uſed for introducing cauteries, either actual or potential, into hollow parts, in order to guard the parts adjacent to that to be cauterized, from injury. They are of various figures; ſome being oval, ſome round, and others crooked.

CANO, a kingdom of Africa, in Negroland, with a town of the ſame name. It is bounded by Zaara on the north, by the river Niger on the ſouth, the kingdom of Agades on the weſt, and that of Caſſina on the eaſt. Some of the inhabitants are herdſmen, and others till the ground and dwell in villages. It produces corn, rice, and cotton. Here are alſo many deſerts and mountains covered with woods, in which are wild citrons and lemon trees. The walls and houſes of the town are made of clay, and the principal inhabitants are merchants. E. Long. 16. 18. N. Lat. 21. 5.

CANOBIA, a town of Italy, in the duchy of Milan, ſeated on the weſtern bank of Lago Maggiore, or the Greater Lake. E. Long. 8. 47. N. Lat. 45. 55.

CANOE, a ſort of Indian boat or veſſel, formed of the trunk of a tree hollowed, and ſometimes of ſeveral pieces of the bark put together.

Canoes are of various ſizes, according to the uſes for which they may be deſigned, or the countries wherein they are formed. The largeſt are made of the cotton tree; ſome of them will carry between 20 and 30 hogſheads of ſugar or molaſſes. Some are made to carry ſail: and for this purpoſe are ſteeped in water till they become pliant; after which their ſides are extended, and ſtrong beams placed between them, on which a deck is afterwards laid that ſerves to ſupport their ſides. The other ſorts very rarely carry ſail, unleſs when going before the wind: their ſails are made of a ſort of ſhort ſilk graſs or ruſhes. They are commonly rowed with paddles, which are pieces of light wood ſomewhat reſembling a corn-ſhovel; and inſtead of rowing with it horizontally like an oar, they manage it perpendicularly. The ſmall canoes are very narrow, having only room for one perſon in breath, and ſeven or eight lengthwiſe. The rowers, who are generally American ſavages, are very expert in managing their paddles uniformly, and in balancing the canoes with their bodies; which would be difficult for a ſtranger to do, how well accuſtomed ſoever to the conducting of European boats, becauſe the canoes are extremely light, and liable to be overturned. The American Indians, when they are under the neceſſity of landing to avoid a water fall, or of croſſing the land from one river to another, carry their canoes on their heads, till they arrive at a place where they can launch them again. This is the general conſtruction of canoes, and method of managing them: but ſome nations have veſſels going under the name of canoes, which differ conſiderably from the above; as the inhabitants of Greenland, Hudſon's-bay, Otaheite, &c.



CANON, a perſon who poſſeſſes a prebend, or revenue allotted for the performance of divine ſervice, in a cathedral or collegiate church.

Canons are of no great antiquity: Paſchier obſerves, that the name canon was not known before Charlemagne; at leaſt the firſt we hear of are in Gregory de Tours, who mentions a college of canons inſtituted by Baldwin XVI. archbiſhop of that city, in the time of Clotharius I. The common opinion attributes the inſtitution of this order to Chrodegangus, biſhop of Metz, about the middle of the eighth century.

Originally canons were only prieſts, or inferior eccleſiaſtics, who lived in community; reſiding by the cathedral church, to aſſiſt the biſhop; depending entirely on his will; ſupported by the revenues of the biſhopric; and living in the ſame houſe, as his domeſtics, or counſellors, &c. They even inherited his moveables till the year 817, when this was prohibited by the council of Aix-la-Chapelle, and a new rule ſubſtituted in the place of that which had been appointed by Chrodegangus, and which was obſerved for the moſt part in the weſt till the twelfth century. By degrees, theſe communities of prieſts, ſhaking off their dependence, formed ſeparate bodies; whereof the biſhops, however, were ſtill heads. In the tenth century, there were communities or congregations of the ſame kind, eſtabliſhed even in cities where there were no biſhops; theſe were called collegiates, as they uſed the terms congregation and college indifferently: the name chapter, now given to theſe bodies, being much more modern. Under the ſecond race of the French kings, the canonical, or collegiate life, had ſpread itſelf all over the country; and each cathedral had its chapter, diſtinct from the reſt of the clergy. They had the name canon from the Greek κανων, which ſignifies three different things; a rule, a penſion, or fixed revenue to live on, and a catalogue or matricula; all which are applicable to them.

In time, the canons freed themſelves from their rules, the obſervance relaxed, and, at length, they ceaſed to live in community: yet they ſtill formed bodies; pretending to other functions beſides the celebration of the common office in the church; yet aſſuming the rights of the reſt of the clergy; making themſelves as a neceſſary council of the biſhop; taking upon them the adminiſtration of a ſee during a vacancy, and the election of a biſhop to ſupply it. There are even ſome chapters exempt from the juriſdiction of the biſhop, and owning no head but their dean. After the example of cathedral chapters, collegiate ones alſo continued to form bodies, after they had abandoned living in community.

CANONS are of various kinds; as,

*Cardinal*

*Cardinal* CANONS, which are thofe attached, and, as the Latins call it, *incardinati* to a church, as a prieft is to a parifh.

*Domicellary* CANONS, where young canons, who not being in orders, had no right in any particular chapters.

*Expectative* CANONS, were fuch as, without having any revenue or prebend, had the title and dignities of canons, a voice in the chapter, and a place in the choir; till fuch time as a prebend fhould fall.

*Foreign* CANONS, were fuch as did not officiate in the canonries to which they belonged. To thefe were oppofed manfionary canons, or canons refidentiary.

*Lay,* or *honorary* CANONS, are fuch among the laity as have been admitted, out of honour and refpect, into fome chapter of canons.

*Regular* CANONS, are canons that ftill live in community; and who, like religious, have, in procefs of time, to the practice of their rules, added the folemn profeffion of vows. They are called regulars, to diftinguifh them from thofe fecular canons who abandon living in community, and at the fame time the obfervance of the canons made as the rule of the clergy, for the maintenance of the ancient difcipline. The canons fubfifted in their fimplicity till the eleventh, fome fay the twelfth century, when fome of them, feparating from the community, took with them the name of canons, or acephalous priefts, becaufe they declined to live in community with the bifhop; and thofe who were left thenceforth acquired the denomination of canons regular, and adopted moft of the profeffions of the rule of St Auguftine. This order of regular canons of St Auguftine was brought into England by Adelwald, confeffor to Henry I. who erected a priory at Noftel in Yorkfhire; and obtained for them the church of Carlifle as an epifcopal fee, with the privilege of choofing their own bifhop. They were fingularly protected and encouraged by Henry I. who gave them the priory of Dunftable in 1107, and by queen Maud, who, in the following year, gave them the priory of the Holy Trinity in London. It appears, that under the reign of Edward I. they had 53 priories.

*Tertiary* CANONS, thofe who had only the third part of the revenues of the canonicate.

CANON, in an ecclefiaftical fenfe, is a law or rule, either of doctrine or difcipline, enacted efpecially by a council, and confirmed by the authority of the fovereign.

Canons are properly decifions of matters of religion; or regulations of the policy and difcipline of a church, made by councils, either general, national, or provincial. Such are the canons of the council of Nice, or Trent, &c.

There have been various collections of the canons of the Eaftern councils; but four principal ones, each ampler than the preceding. The firft, according to Ufher. A. D. 380, containing only thofe of the firft œcumenical council, and the firft provincial ones: they were but 164 in number. To thefe Dionyfius Exiguus, in the year 520, added the 50 canons of the apoftles, and thofe of the other general councils. The Greek canons in this fecond collection end with thofe of the council of Chalcedon; to which are fubjoined thofe of the council of Sardica, and the African councils. The fourth and laft collection comes down as low as the fecond council of Nice; and it is on this that Balfamon and Zonaras have commented.



*Apoftolical* CANONS, are thofe which have been ufually afcribed to St Clement. Bellarmin, Baronious, &c. will have them to be genuine canons of the apoftles: Cotelerius obferves, that they cannot be afcribed to the apoftles or Clement, becaufe they are not received with other books of fcripture, are not quoted by the writers of the firft ages, and contain many things not agreeable to the apoftolical times: Hincmar, De Marca, Beveridge, &c. take them to be framed by the bifhops who were the apoftles difciples in the fecond or third century; S. Bafnage is of opinion, that they were collected by an anonymous writer in the fifth century; but Daille, &c. maintain them to have been forged by fome heretic in the fixth century; and S. Bafnage conjectures, that fome of them are ancient, and others not older than the feventh century. The Greek church allow only 85 of them, and the Latins only 50; though there are 84 in the edition given of them in the Corpus Juris Canonici.

CANON is alfo ufed for the authorifed catalogue of the facred writings. See BIBLE.

The ancient canon, or catalogue of the books of the Old Teftament, was made by the Jews, and is ordinarily attributed to Ezra; who is faid to have diftributed them into the law, the prophets, and the hagiographa, to which our Saviour refers, Luke, chap. xxiv. ver. 44. The fame divifion is alfo mentioned by Jofephus, cont. Appion.

This is the canon allowed to have been followed by the primitive church, till the council of Carthage; and, according to St Jerom, this confifted of no more than 22 books; anfwering to the number of the Hebrew alphabet; though at prefent they are claffed into 24 divifions, containing Genefis, Exodus, Leviticus, Numbers, Deuteronomy, Jofhua, Judges, Samuel, Kings, Ifaiah, Jeremiah, Ezekiel, the twelve minor prophets, the Pfalms, the Proverbs, Job, Canticles, Ruth, Lamentations, Ecclefiaftes, Efther, Daniel, Ezra, comprehending the book of Nehemiah and the Chronicles. However, this order is not univerfally obferved, either among Jews or Chriftians: nor were all the books above enumerated admitted into the canon in Ezra's time. It is moft likely, fays Dr Prideaux, that the two books of Chronicles, Ezra, Nehemiah, Efther, and Malachi, were added in the time of Simon the Juft, when the canon was completed. But that council enlarged the canon very confiderably, taking into it the books which we call apocryphal; which the council of Trent has further enforced, enjoining all thefe to be received as books of Holy Scripture, upon pain of anathema, and being attainted of herefy. The Romanifts, in defence of this canon, fay, that it is the fame with that of the Council of Hippo, held in 393; and with that of the third council of Carthage, in 397; at which were prefent 46 bifhops, and, among the reft, St Auguftine; who declared that they received it from their fathers.

Their canon of the new teftament perfectly agrees with ours. It confifts of books that are well known; fome of which have been univerfally acknowledged; fuch are the four Gofpels, the Acts of the Apoftles, thirteen Epiftles of St Paul, one Epiftle of St Peter, and

and one Epistle of St John: and others, concerning which doubts were entertained, but which were afterwards received as genuine; such are the epistle to the Hebrews, that of James, the second of Peter, the second and third of John, that of Jude, and the Revelation. These books were written at different times, and they are authenticated, not by the decrees of councils, or infallible authority, but by such kinds of evidence as is thought sufficient in the case of any other ancient writings. They were very extensively diffused; they were read in every Christian society; they were valued and preserved with care by the first Christians; they were cited by Christian writers of the second, third and fourth century, as by Irenæus, Clement the Alexandrian, Tertullian, Origen, Eusebius, &c. and their genuineness is proved by the testimony of those who were contemporary with the apostles themselves, and by tradition. The four Gospels, and most of the other books of the New Testament, were collected either by one of the apostles, or some of their disciples and successors, before the end of the first century. The catalogue of canonical books furnished by the more ancient Christian writers, as Origen about the year 210, Eusebius and Athanasius in 315, Epiphanius in 370, Jerome in 382, Austin in 394, and many others, agrees with that which is now received among Christians. For the time of writing the several books of the New Testament, see the titles of the books themselves; as the Gospel of St MATTHEW, MARK, &c.

Some of the fathers distinguish the inspired writings into three classes; proto-canonical, deutero-canonical, and aprocryphal.

*Paschal CANON*, a table of the moveable feasts, showing the day of Easter, and the other feasts depending on it, for a cycle of 19 years.

The paschal canon is supposed to be the calculation of Eusebius of Cæsarea; and to have been done by order of the council of Nice.

CANON, in monastic orders, a book wherein the religious of every convent have a fair transcript of the rules of their order, frequently read among them as their local statutes. This is also called *regula*, as containing the rule and institution of their order.

The canon differs from the missale, martyrologium, and necrologium.

CANON, again, is used for the catalogue of Saints acknowledged and canonized in the Roman church.

CANON is also used, by way of excellence in the Romish church, for the secret words of the mass, from the preface to the *Pater;* in the middle of which the priest consecrates the host. The common opinion is, that the canon of the mass commences with *Te igitur*, &c. The people are to be on their knees, hearing the canon; and are to rehearse it to themselves, so as not to be heard.

CANON, in the ancient music, is a rule or method of determining the intervals of notes.

Ptolemy rejecting the Aristoxenian way of measuring the intervals in music, by the magnitude of a tone (which was supposed to be formed by the difference between a diapente and a diatessaron), thought that musical intervals should be distinguished, according to the ratios or proportions which the sounds terminating those intervals bear to one another, when considered according to their degree of acuteness or gravity; which, before Aristoxenus, was the old Pythagorean way. He therefore made the diapason consist in a double ratio; the diapente, in a sesquialterate; the diatessaron, in a sesquitertian; and the tone itself, in a sesquioctave; and all the other intervals, according to the proportion of the sounds that terminate them: wherefore taking the canon (as it is called) for a determinate line of any length, he shows how this canon is to be cut accordingly, so that it may represent the respective intervals: and this method answers exactly to experiment, in the different lengths of musical chords. From this canon, Ptolemy and his followers have been called *Canonici;* as those of Aristoxenus were called *Musici.*

CANON, in modern music, is a kind of fugue, which they call a *perpetual fugue*, because the different parts beginning one after another, repeat incessantly the same air.

Formerly, says Zarlino, they placed, at the head of perpetual fugues, particular directions which showed how this kind of fugues was to be sung; and these directions being properly the rules by which perpetual fugues were composed were called *canoni, rules*, or *canons*. From this custom, others taking the title for the thing signified, by a metonimy, termed this kind of composition *canon*. Such canons as are composed with the greatest facility, and of consequence most generally used, begin the fugue either with the octave or the unison; that is to say, that every part repeats in the same tone the melody of the preceding. In order to form a canon of this kind, it is only necessary for the composer to make an air according to his taste; to add in score as many parts as he chooses, where the voices in octave or unison repeat the same melody; then forming a single air from all these parts successively executed, to try whether this succession may form an entire piece which will give pleasure, as well in the harmony as the melody.

In order to execute such a *canon*, he who sings the first part begins alone, and continues till the air is finished; then recommences immediately, without any suspence of sound or interruption of time: as soon as he has ended the first couplet, which ought to serve for the perpetual subject upon which the whole *canon* has been composed, the second part begins and repeats the same couplet, whilst the first who had begun pursues the second: others in succession begin, and proceed the same way, as soon as he who precedes has reached the end of the first couplet. Thus, by incessantly recommencing, an universal close can never be found, and the *canon* may be repeated as long as the singers please.

A perpetual fugue may likewise consist of parts which begin with the intervals of a fourth or fifth, or, in other words, every part may repeat the melody of the first, a fourth, or a fifth higher or lower. It is then necessary that the whole *canon* should be invented *di prima intenzione*, as the Italians say; and that sharps or flats should be added to the notes, whose natural gradations do not answer exactly, by a fourth or fifth, to the melody of the preceding part, and produce the same intervals with itself. Here the composer cannot pay the least regard to modulation; his only care is, that the melody may be the same, which renders the formation

of

of a *canon* more difficult; for at every time when any part resumes the fugue, it takes a new key; it changes the tone almost at every note, and what is still worse, no part is at the same time found in the same tone with another; hence it is that this kind of *canons*, in other respects far from being easy to be pursued, never produces a pleasing effect, however good the harmony may be, and however properly it may be sung.

There is a third kind of *canon*, but very scarce, as well because it is extremely difficult, as because it is for the most part incapable of giving pleasure, and can boast no other merit but the pains which have been thrown away in its composition. This may be called a *double canon inverted*, as well by the inversions which are practised in it with respect to the melody of the parts, as by those which are found among the parts themselves, in singing. There is such an artifice in this kind of *canon*, that, whether the parts be sung in their natural order, or whether the paper in which they are set be turned the contrary way, to sing them backward from the end to the beginning, in such a manner that the bass becomes the upper part, and the rest undergo a similar change, still you have pretty harmony, and still a regular *canon*. The reader may consult Rousseau's Dictionary in this article, where he is referred to plate D fig. 11. for two examples of canons of this sort extracted from Bontempi, who likewise gives rules for their composition. But he adds, that the true principle from which this rule is deduced will be found at the word *Systeme*, in his account of the system of Tartini, to which we must likewise once more refer the reader; as a quotation of such length must have protracted our article to an enormous extent.

To form a *canon* in which the harmony may be a little varied, it is necessary that the parts should not follow each other in a succession too rapid, and that the one should only begin a considerable time after the other. When they follow one another so immediately as at the distance of a semibreve or minim, the duration is not sufficient to admit a great number of chords, and the canon must of necessity exhibit a disagreeable monotony; but it is a method of composing, without much difficulty, a canon in as many parts as the composer chooses. For a *canon* of four bars only, will consist of eight parts if they follow each other at the distance of half a bar; and by each bar which is added, two parts will constantly be gained.

The emperor Charles VI. who was a great musician, and composed extremely well, took much pleasure in composing and singing *canons*. Italy is still replete with most beautiful *canons* composed for this prince, by the best masters in that country. To what has been said by Rousseau, we need only subjoin, that the English *catch* and the Italian *canon* are much the same; as any intelligent reader may perceive, from comparing the structure and execution of the English *catch* with the account of *canons* which has now been given.

CANON, in geometry and algebra, a general rule for the solution of all cases of a like nature with the present inquiry. Thus every last step of an equation is a canon; and, if turned into words, becomes a rule to solve all questions of the same nature with that proposed.

*CANON-Law*, a collection of ecclesiastical laws, serving as the rule and measure of church-government.



The power of making laws was exercised by the church before the Roman empire became Christian. The canon-law that obtained throughout the West, till the 12th century, was the collection of canons made by Dionysius Exiguus in 520, the capitularies of Charlemagne, and the decrees of the popes from Sircius to Anastasius.

The canon-law, even when papal authority was at its height in England, was of no force when it was found to contradict the prerogative of the king, the laws, statutes, and customs of the realm, or the doctrine of the established church.

The ecclesiastical jurisdiction of the see of Rome in England was founded on the canon-law; and this created quarrels between kings and several archbishops and prelates who adhered to the papal usurpation.

Besides the foreign canons, there were several laws and constitutions made there for the government of the church: but all these received their force from the royal assent; and if, at any time, the ecclesiastical courts did, by their sentence, endeavour to enforce obedience to such canons, the courts at common law, upon complaints made, would grant prohibition. The authority vested in the church of England of making canons, was ascertained by a statute of Henry VIII. commonly called the *act of the clergy's submission*; by which they acknowledged, that the convocation had always been assembled by the king's writ; so that though the power of making canons resided in the clergy met in convocation, their force was derived from the authority of the king's assenting to, and confirming them.

The old canons continued in full force till the reign of James I. when the clergy being assembled in convocation, the king gave them leave to treat and consult upon canons; which they did, and presented them to the king, who gave them the royal assent: these were a collection out of the several preceding canons and injunctions. Some of these canons are now obsolete. In the reign of Charles I. several canons were passed by the clergy in convocation.

CANONESS, in the Romish church, a woman who enjoys a prebend, affixed, by the foundation, to maids, without their being obliged to renounce the world or make any vows.

CANONICA, in philosophical history, an appellation given by Epicurus to his doctrine of logic. It was called *canonica*, as consisting of a few canons or rules for directing the understanding in the pursuit and knowledge of truth. Epicurus's *canonica* is represented as a very slight and insufficient logic by several of the ancients, who put a great value on his ethics and physics. Laertius even assures us, that the Epicureans rejected logic as a superfluous science; and Plutarch complains that Epicurus made an unskilful and preposterous use of syllogisms. But these censures seem too severe. Epicurus was not averse to the study of logic, but even gave better rules in this art than those philosophers who aimed at no glory but that of logics. He only seems to have rejected the dialectics of the stoics, as full of vain subtleties and deceits, and fitted rather for parade and disputation than real use. The stress of Epicurus's *canonica* consists in his doctrine of the criteria of truth. All questions in philosophy are either concerning words or things: concerning things, we feek their truth; concerning words, their fignification: things are either natural or moral; and the former are either perceived by fenfe or by the underftanding. Hence, according to Epicurus, arife three criterions of truth, *viz.* fenfe, anticipation or prænotion, and paffion. The great canon or principle of Epicurus's logic is, that the fenfes are never deceived; and therefore, that every fenfation or perception of an appearance is true.

CANONICAL, fomething that belongs to, or partakes of, the nature of a rule or canon.

*CANONICAL Hours*, are certain ftated times of the day, configned, more efpecially by the Romifh church, to the offices of prayer and devotion. Such are *matins, lauds, fixth, ninth, vefpers*. In Britain the canonical hours are from eight to twelve in the forenoon, before or after which marriage cannot be legally performed in any parifh-church.

*CANONICAL Obedience*, is that fubmiffion which, by the ecclefiaftical laws, the inferior clergy are to pay to their bifhops, and religious to their fuperiors.

*CANONICAL Sins*, in the ancient church, thofe which were capital or mortal. Such efpecially were idolatry, murder, adultery, herefy, and fchifm.

*CANONICAL Punifhments*, are thofe which the church may inflict; fuch as excommunication, degradation, and penance; in Roman Catholic countries, alfo fafting, alms, whipping, &c.

*CANONICAL Life*, the method or rule of living prefcribed by the ancient clergy who lived in community. The canonical life was a kind of medium between the monaftic and clerical lives. Originally the orders of monks and clerks were entirely diftinct; but pious perfons, in procefs of time, inftituted colleges of priefts and canons, where clerks brought up for the miniftry, as well as others already engaged therein, might live under a fixed rule, which, though fomewhat more eafy than the monaftic, was yet more reftrained than the fecular. This was called the *canonical life*, and thofe who embraced it *canons*.—Authors are divided about the founder of the canonical life. Some will have it to be founded by the apoftles; others afcribe it to pope Urban I. about the year 1230, who is faid to have ordered bifhops to provide fuch of their clergy as were willing to live in community, with neceffaries out of the revenues of their churches. The generality attribute it to St Auguftine; who, having gathered a number of clerks to devote themfelves to religon, inftituted a monaftery within his epifcopal palace, where he lived in community with them. Onuphrius Panvinius brings the inftitution fomewhat lower: according to him, pope Gelafius I. about the year 495, placed the firft regular canons of St. Auguftine in the Lateran church.

*CANONICAL Letters*, in the ancient church, were a fort of teftimonials of the orthodox faith, which the bifhops and clergy fent each other to keep up the catholic communion, and diftinguifh orthodox Chriftians from Arians and other heretics. They were denominated *canonical*, either as being compofed according to a certain rule or form, or becaufe they were given to the *canonici*, that is, thofe comprehended in the canon or catalogue of their church. When they had occafion to travel into other diocefes or countries, dimiffory and recommendatory letters, alfo letters of peace, &c. were fo many fpecies of canonical letters.



CANONICAL is alfo an appellation given to thofe epiftles in the New Teftament more frequently called *catholic* or *general* epiftles.

CANONICUM, in a general fenfe, denotes a tax or tribute.

CANONICUM is more particularly ufed in the Greek church for a fee paid by the clergy to bifhops, archbifhops, and metropolitans, for degrees and promotions.

CANONICUM alfo denotes a due of firft-fruits, paid by the Greek laity to their bifhops, or, according to Du-Cange, to their priefts. The *canonicum* is affeffed according to the number of houfes or chimnies in a place.

The emperor Ifaac Comnenus made a conftitution for regulating the *canonicum* of bifhops, which was confirmed by another made in 1086, by his nephew Alexis Comnenus. A village containing thirty fires, was to pay for its *canonicum* one piece of gold, two of filver, one fheep, fix bufhels of barley, fix of wheat flour, fix meafures of wine, and thirty hens.

CANONIST, a perfon fkilled in or who makes profeffion of the ftudy and practice of the canon law. Canonifts and civilians are ufually combined in the fame perfons: and hence the title of *doctor juris utriufque*, or *legum doctor*, ufually expreffed in abbreviature, L. L. D. or J. U. D.

CANONIZATION, a ceremony in the Romifh church, by which perfons deceafed are ranked in the catalogue of the faints. It fucceeds beatification.

Before a beatified perfon is canonized, the qualifications of the candidate are ftrictly examined into, in fome confiftories held for that purpofe; after which, one of the confiftorial advocates, in the prefence of the pope and cardinals, makes the panegyric of the perfon who is to be proclaimed a faint, and gives a particular detail of his life and miracles: which done, the holy father decrees his canonization, anda ppoints the day.

On the day of canonization the pope officiates in white, and their eminences are dreft in the fame colour. St Peter's church is hung with rich tapeftry, upon which the arms of the pope, and of the prince or ftate requiring the canonization, are embroidered in gold and filver. An infinite number of lights blaze all round the church, which is crowded with pious fouls, who wait with devout impatience till the new faint has made his public entry as it were into paradife, that they may offer up their petitions to him without danger of being rejected.

The following maxim with regard to canonization is now obferved, though it has not been followed above a century, *viz.* not to enter into the inquiries prior to canonization, till 50 years, at leaft, after the death of the perfon to be canonized. By the ceremony of canonization, it appears that this rite of the modern Romans has fomething in it very like the apotheofis or deification of the ancient Romans, and, in all probability, takes its rife from it; at leaft feveral ceremonies of the fame nature are confpicuous in both.

CANONRY, the benefice filled by a canon. It differs from a prebend, in that the prebend may fubfift without

Canopus, Canosa.

without the canonicate: whereas the canonicate is inseparable from the prebend: again, the rights of suffrages, and other privileges, are annexed to the canonicate, and not to the prebend.

CANOPUS, in astronomy, a star of the first magnitude in the rudder of Argo, a constellation of the southern hemisphere.

CANOPUS, in Pagan mythology, one of the deities of the ancient Egyptians, and, according to some, the god of water. It is said, that the Chaldeans, who worshipped fire, carried their fancied deity thro' other countries to try its power, in order that, if it obtained the victory over the other gods, it might be acknowledged as the true object of worship; and it having easily subdued the gods of wood, stone, brass, silver, and gold, its priests declared, that all gods did it homage. This the priests of Canopus hearing, and finding that the Chaldeans had brought their god to contend with Canopus, they took a large earthen vessel, in which they bored several holes, which they afterwards stopped with wax, and having filled the vessel with water, painted it of several colours, and fitting the head of an idol to it, brought it out, in order to contend with the Chaldean deity. The Chaldeans accordingly kindled their fire all around it; but the heat having melted the wax, the water gushed out thro' the holes, and extinguished the fire; and thus Canopus conquered the god of the Chaldeans.

CANOPUS, or *Canobus*, according to Strabo, had been Menelaus's pilot, and had a temple erected to him in a town called *Canopus*, near one of the mouths of the Nile. Dionysius mentions it.

> Και τεμενος περιπυστον Αμυκλαι οιο Κανωβυ,
> There stands Canobus' temple known to fame;
> The pilot who from fair Amycla came.

Vossius remarks, on this occasion, the vanity of the Greeks, who, as he conjectures, hearing of an Egyptian deity named *Canopus*, took from thence an opportunity of deifying the pilot of Menelaus who bore the same name, and giving out that the Egyptian god Canopus had been a Greek. F. Monfaucon gives several representations of this deity. One, in allusion to the victory abovementioned, throws out water on every side through little holes.

CANOPUS, or *Canobus*, (anc. geog.) a town of the Lower Egypt, on the Mediterranean, an hundred and twenty stadia, or fifteen miles to the east of Alexandria; as old as the war of Troy, Canopus, or Canobus, Menelaus's steersman, being there buried. *Canopaei*, the gentilitious name: famous for their luxury and debauchery, (Strabo, Juvenal.) See ABOUKIR.

CANOPY, in architecture and sculpture, a magnificent kind of decoration, serving to cover and crown an altar, throne, tribunal, pulpit, chair, or the like. The word is formed from the barbarous Latin *canopeum*, of κωνωπειον, *a net spread over a bed to keep off the gnats*, κωνωψ, *a gnat*.

Canopies are also borne over the head in processions of state, after the manner of umbrellas. The canopy of an altar is more peculiarly called *Ciborium*.

The Roman grandees had their canopies, or spread veils, called *thensæ*, over their chairs: the like were also in temples over the statues of the gods. The modern cardinals still retain the use of canopies.

CANOSA, a town of Puglia in Italy, occupying part of the site of the ancient Canusium. The old city was founded by Diomede, according to Strabo. It afterwards became a Roman colony, and one of the most considerable cities of this part of Italy for extent, population, and magnificence in building. The æra of Trajan seems to have been that of its greatest splendour; but this pomp only served to mark it as a capital object for the avarice and fury of the Barbarians. Genseric, Totila, and Autharis, treated it with extreme cruelty. The deplorable state to which this province was reduced in 590 is concisely but strongly painted by Gregory the Great, in these terms: "On every side we hear groans! on every side we behold crowds of mourners, cities burnt, castles rased to the ground, countries laid waste, provinces become deserts, some citizens led away captives, and others inhumanly massacred." No town in Puglia suffered more than Canosa from the outrages of the Saracens; the contests between the Greeks and Normans increased the measure of its woes, which was filled by a conflagration that happened when it was stormed by duke Robert. In 1090, it was assigned, by agreement, to Bohemund prince of Antioch, who died here in 1111. Under the reign of Ferdinand the Third, this estate belonged to the Grimaldis. On their forfeiture, the Affaititi acquired it, and still retain the title of marquis, though the Capeci are the proprietors of the fief.

*Swinburn's Travels in Sicily*, page 408.

Canosa ‖ Cant.

The ancient city stood in a plain between the hills and the river Ofanto, and covered a large tract of ground. Many brick monuments, though degraded and stripped of their marble casing, still attest its ancient grandeur. Among them may be traced the fragments of aqueducts, tombs, amphitheatre baths, military columns, and two triumphal arches, which, by their position, seem to have been two city gates. The present town stands above, on the foundations of the old citadel, and is a most pitiful remnant of so great a city, not containing above three hundred houses. The church of St Sabinus, built, as is said, in the sixth century, is now without the inclosure. It is astonishing, that any part of this ancient cathedral should have withstood so many calamities. Its altars and pavements are rich in marbles; and in a small court adjoining, under an octagonal cupola, is the mausoleum of Bohemund, adorned in a minute Gothic style.

CANSO, a sea-port town of Acadia, or Nova Scotia, in North America, seated on a narrow strait which separates Nova Scotia from Cape Breton. Near this town is a fine fishery for cod. W. Long. 62. N. Lat. 46.

CANSTAT, a town of Swabia, in Germany, in the duchy of Wirtemberg, situated on the river Neckar, in E. Long. 9. 9. N. Lat. 48. 51.

CANT, a quaint affected manner of speaking, adapted chiefly to the lower sort. Skinner racks his invention for the origin of this word; which he successively deduces from the German, Flemish, and Saxon tongues. According to the general opinion, Cant is originally the proper name of a Cameronian preacher in Scotland, who by exercise had obtained the faculty of talking in the pulpit in such a tone and dialect as was understood by none but his own congregation: since Andrew Cant's time, the word has been extended to signify all sudden exclamations, and whining unmusical tones, especially in praying and preaching. But this origin

origin of the word has been diſputed by others; and perhaps the true derivation is from the Latin *cantare* "to ſing."

CANT is alſo applied to words and phraſes affected by particular perſons or profeſſions for low ends, and not authoriſed by the eſtabliſhed language*. The difference between *cant* and *technical* ſeems to be this: the former is reſtrained to words introduced out of folly, affectation, or impoſture; the latter is applied to ſuch as are introduced for the ſake of clearneſs, preciſion, and ſignificancy.

* See *Canting Language*.

CANT is alſo uſed to denote a ſale by auction. The origin of the word in this ſenſe is dubious; it may come, according to ſome, from *quantum*, how much; according to others, from *cantare*, to ſing or cry aloud; agreeably to which, we ſometimes alſo call it an *outcry*.

*CANT-Timbers*, in ſhip-building, thoſe timbers which are ſituated at the two ends of a ſhip. They derive their name from being *canted*, or raiſed obliquely from the keel; in contradiſtinction from thoſe whoſe planes are perpendicular to it. The upper ends of thoſe on the bow, or fore-part of the ſhip, are inclined to the ſtern; as thoſe in the after, or hind part, incline to the ſtern-poſt above. See *SHIP-Building*.

CANTABRIA, (anc. geog.) a diſtrict of Terraconenſis, on the Oceanus Cantabricus or bay of Biſcay; now BISCAY. The inhabitants were famous for their warlike character. In conjunction with the Aſturians†, they carried on deſperate wars with the Romans; but were ſubdued by them about 25 years before Chriſt. Being impatient, however, of a foreign yoke, they in a few years revolted. Moſt of their youth had been already taken priſoners by the Romans, and ſold for ſlaves to the neighbouring nations: but having found means to break their chains, they cut the throats of their maſters; and returning into their own country, attacked the Roman garriſons with incredible fury. Agrippa marched againſt them with great expedition; but, on his arrival, met with ſo vigorous a reſiſtance, that his ſoldiers began to deſpair of ever being able to reduce them. As the Cantabrians had waged war with the Romans for upwards of 200 years, they were well acquainted with their manner of fighting, no way inferior to them in courage, and were now become deſperate; well knowing, that if they were conquered, after having ſo often attempted to recover their liberty, they muſt expect the moſt ſevere uſage, and cruel ſlavery. Animated with this reflection, they fell upon the Romans with a fury hardly to be expreſſed, routed them in ſeveral engagements, and defended themſelves when attacked by the enemy with ſuch intrepidity, that Agrippa afterwards owned, that he had never, either by ſea or land, been engaged in a more dangerous enterprize. That brave commander was obliged to uſe intreaties, menaces, and to brand ſome of his legionaries with ignominy, before he could bring them to enter the liſts with ſuch a formidable enemy. But having at laſt, with much ado, prevailed upon them to try the chance of an engagement in the open field, he ſo animated them by his example, that after a moſt obſtinate diſpute, he gained a complete victory, which indeed coſt him dear, but put an end to that deſtructive war. All the Cantabrians fit to bear arms were cut in pieces; their caſtles and ſtrong holds taken and raſed; and their women, children, and old men (none elſe being left alive), were obliged to abandon the mountainous places, and ſettle in the plain.

† See *Aſturia*.



Dr Wallis ſeems to make the Cantabrian the ancient language of all Spain: which, according to him, like the Gauliſh, gave way to a kind of broken Latin called *romance*, or *romanſhe*; which by degrees was refined into the Caſtilian or preſent Spaniſh. But we can hardly ſuppoſe, that ſo large a country, inhabited by ſuch a variety of people, ſpoke all the ſame language. The ancient Cantabrian, in effect, is ſtill found to ſubſiſt in the more barren and mountainous parts of the province of Biſcay, Aſturias, and Navarre, as far as Bayonne, much as the Britiſh does in Wales; but the people only talk it: for writing, they uſe either the Spaniſh or French, as they happen to live under the one or the other nation. Some attribute this to jealouſy of foreigners learning the myſteries of their language; others to a poverty of words and expreſſions. The Cantabrian does not appear to have any affinity with any other known language, abating that ſome Spaniſh words have been adopted in it for things whoſe uſe the Biſcayens were anciently unacquainted with. Its pronunciation is not diſagreeable. The Lord's prayer, in the Cantabarian tongue, runs thus: *Gure aita cervetan aicena, ſantifica bedi hire icena, ethor bedi hire reſuma, eguin bedi hire vorondatea cervan becala lurrean ere*, &c.

CANTABRICA, in botany: A ſynonime of a ſpecies of CONVOLVULUS.

CANTABRUM, in antiquity, a large kind of flag uſed by the Roman emperors, diſtinguiſhed by its peculiar colour, and bearing on it ſome words or motto of good omen, to encourage the ſoldiers.

CANTACUZENUS, (Johannes) of Conſtantinople, a celebrated ſtateſman, general, and hiſtorian, was born in that city, of a very ancient and noble family. He was bred to letters and to arms, and admitted to the higheſt offices of the ſtate. The emperor Andronicus loaded him with wealth and honour; made him generaliſſimo of his forces; and was deſirous of having him join him in the government, but this he refuſed. Andronicus dying in 1341, left to Cantacuzenus the care of the empire, till his ſon John Paleologus, who was then but nine years of age, ſhould be fit to take it upon himſelf. This truſt he faithfully diſcharged; till the empreſs dowager and her faction forming a party againſt him, declared him a traitor. On this the principal nobility and the army beſought him to aſcend the throne; and accordingly he was crowned on the 21ſt of May 1342. This was followed by a civil war, which laſted five years; when he admitted John a partner with him in the empire, and their union was confirmed by his giving him his daughter in marriage. Suſpicions and enmities, however, ſoon ariſing, the war broke out again, and continued till John took Conſtantinople in 1355. A few days after, Cantacuzenus, unwilling to continue the effuſion of blood, abdicated his ſhare of the empire and retiring to a monaſtery, took the habit of a monk, and the name of *Joaſaphas*. His wife alſo retired to a nunnery, and changed her name of *Irene* for that of *Eugenia*. In this retirement he lived till the year 1411, when he was upwards of 100 years of age. Here he wrote a hiſtory of his own times, a Latin tranſlation of which, from the Greek manuſcript, was pub-

Cantalivers Cantemir.

published by Pontanus at Ingolstadt, in 1603: and a splendid edition was printed at Paris in 1645, in three volumes folio, of the original Greek, and Pontanus's Latin version. He also wrote an apology for the Christian religon against that of Mahomet, under the name of *Christodulus*.

CANTALIVERS, in architecture, pieces of wood framed into the front or sides of a house, to suspend the mouldings and eyes over it.

CANTAR, or CANTARO, an eastern weight, of different value in different places, equal at Acra in Turkey to 603 pounds, at Tunis and Tripoli to 114 pounds.

CANTAR is also an Egyptian weight, which is denominated a *quintal*, and consists of an hundred or of an hundred and fifty rotolos, according to the goods they are to weigh.

CANTARO is also an Egyptian weight, which at Naples is equivalent to 25 pounds, at Genoa to 150 pounds. At Leghorn there are three kinds of *cantaros*, one weighing 150 pounds, another 151, and a third 160 pounds.

CANTARO is also a Spanish liquid measure, in use especially at Alicant, containing three gallons.

CANTARO is also a measure of capacity, used at Cochin, containing four rubies, the rubi 32 rotolos.

CANTARINI, (Simon) a famous painter, called the *Pesarese*, from his being born at Pesaro, was the disciple of Guido; and copied the manner of his master so happily, that it is often difficult to distinguish between their works. He died at Verona in 1648.

CANTATA, in music, a song or composition, intermixed with recitatives, airs, and different movements, chiefly intended for a single voice, with a thorough bass, though sometimes for other instruments.

The cantata, when performed with judgment, has something in it very agreeable; the variety of the movement not clogging the ear, like other compositions. It was first used in Italy, then in France, whence it passed to us.

CANTAZARO, an episcopal city of Italy, in the kingdom of Naples, and in the territory of Calabria Ulterior. It is the residence of the governor of the province, and is seated near the sea, in E. Long. 17. 0. N. Lat. 38. 59.

CANTECROIX, a small territory of the Netherlands, in Brabant, and in the quarter of Antwerp, with the title of a principality; there is a small town of the same name, but Lire is the capital.

CANTEMIR, (Demetrius) son of a prince of Moldavia. Disappointed by not succeeding his father in that dignity, held under the Ottoman Port, he went over with his army to the Czar Peter the great, against whom he had been sent by the Grand Signior: he signalized himself in the Czar's service; and in the republic of letters, by a Latin history of the origin and decline of the Ottoman empire, &c. Died in 1723.

CANTEMIR, (Antiochus) esteemed the founder of the Russian poetry, was the youngest son of the preceding. Under the most ingenious professors, whom the czar had invited to Petersburgh, he learned mathematics, physic, history, moral philosophy, and polite literature; without neglecting the study of the Holy Scriptures, to which he had a great inclination. Scarce had he finished his academic course, when he printed a Concordance to the Psalms in the Russian language, and was elected member of the academy. The affairs of state in which he was soon after engaged, did not make him neglect his literary pursuits. In order to make himself useful to his fellow-citizens, he composed his satires, to ridicule certain prejudices which had got footing among them. When but 23 years of age, he was nominated minister at the court of Great Britain; and his dexterity in the management of public affairs was as much admired as his taste for the sciences. He had the same reputation in France, whither he went in 1738, in quality of minister plenipotentiary, and soon after was invested with the character of ambassador extraordinary. The wise and prudent manner in which he conducted himself during the different revolutions which happened in Russia during his absence, gained him the confidence and esteem of three successive princes. He died of a dropsy, at Paris, in 1744, aged 44. Besides the pieces already mentioned, he wrote, 1. Some fables and odes. 2. A translation of Horace's epistles into Russian verse. 3. A prose translation of Fontenelle's plurality of worlds; and, 4. Algarotti's dialogues on sight. The abbe Guasco has written his life in French, and translated his satires into that language.

Cantemir, Canterbury.

CANTERBURY, a city of England, and capital of the county of Kent, situated in E. Long. 1. 15. N. Lat. 51. 16. It had the names of *Durovernum* and *Darvernum* given it by the Romans, and *Durobernia* by Bede, which are thought to be derived from *Durwhem*, signifying a rapid stream, such as the Stour, on which it stands, is. The Britons call it *Caer-Kent*, i. e. the city of Kent; and its present English name is of the same import, derived from the Saxon. Modern writers in Latin call it *Cantuaria*. Its great antiquity appears not only from Antoninus's itinerary, but from the military way which has been discovered here, and the causeways leading to Dover and Lymme, besides the coins and other curiosities found about it. The archiepiscopal and metropolitical dignity seems to have been settled here very early; and to prevent its being removed, an anathema was decreed against any who should attempt it. After that, the city flourished greatly; though it suffered in common with other towns during the Danish invasions, and at other times by the casualties of fire. The city was given entirely to the bishops by William Rufus, and was held in the utmost veneration in the Popish times, especially after the murder of Becket in the reign of Henry II. to whose shrine so great was the resort, and so rich were the offerings, that Erasmus, who was an eye-witness of its wealth, says the whole church and chapel in which he was interred glittered with jewels; and at the dissolution, the plate and jewels filled two great chests, each of which required eight strong men to carry out. The cathedral was granted by Ethelbert, king of Kent, upon his conversion, to Austin the monk, together with his palace, and the royalty of the city and its territories. This Austin founded a monastery for monks, called from him *Augustine*. After the cathedral had been several times destroyed by fire and rebuilt, the present was begun about the year 1174, and augmented and embellished by the succeeding archbishops, till it was completed in the reign of Henry V. It is a noble Gothic pile, and before the reformation had 37 altars. A great many kings, princes, cardinals, and archbishops, are buried in it. At the dissolution, Henry VIII. seized all the revenues both of the church and monastery, except what he allotted for the maintenance of a dean, 12 prebendaries, and six preachers, whom he established in place of the monks. During the grand rebellion, it suffered much; the usurper Cromwell having made a stable of it for his dragoons. After the restoration, it was repaired, and made what it now appears.

Besides the cathedral and other churches, as well as a monastery, the city had anciently a castle on the south-side, and strong walls, with towers, a ditch, and rampart; it had also a mint and an exchange. As to its government, it seems to have been entirely subject to the archbishop, both in spirituals and temporals; at least from the time that William Rufus gave it solely to bishop Anselm, till the reformation. It is now a county of itself; and the corporation consists of a mayor, recorder, 12 aldermen, a sheriff, 24 common-council-men, a mace-bearer, sword-bearer, and four serjeants at mace. Every Monday a court is held at Guildhall for civil and criminal causes; and every other Tuesday for the government of the city. Here were formerly 2000 or 3000 French Protestants employed in the silk manufacture; but this branch is now greatly decayed in the place, since Spitalfields became so flourishing. Besides the cathedral, it contains 15 parish-churches, seven hospitals, a free-school, a house of correction, a gaol for criminals, and a sumptuous conduit for supplying the inhabitants with water. It consists of four streets, disposed in the form of a cross, and divided into six wards, which are about three miles in circumference. It is surrounded on all hands with hop-grounds much to its advantage, and is famed for its excellent brawn.

The diocese of Canterbury contains 257 parishes, besides chapels, in Kent, and about 100 more in other dioceses. These are called *Peculiars*; it being an ancient privilege of this see, that, wheresoever the archbishops had either manors or advowsons, the place was exempted from the jurisdiction of the ordinary of the diocese where it was situated, and was deemed in the diocese of Canterbury. This see is valued in the king's books at L. 2816 : 17 : 9¼, but is reckoned to produce a clear revenue of L. 8000 a-year. The clergy's tenths come to L. 651 : 18 : 2¼. This see had many great privileges in the time of Popery, some of which it still retains. The archbishop is accounted primate and metropolitan of all England, and is the first peer in the realm; having the precedence of all dukes, not of the blood-royal, and all the great officers of state. In common speech, he is styled *His Grace*, and he writes himself *Divina Providentia*; whereas other bishops style themselves *Divina Permissione*. At coronations, he places the crown on the king's head; and, wherever the court may be, the king and queen are the proper domestic parishioners of the archbishop of Canterbury. The bishop of London is accounted his provincial dean, the bishop of Winchester his sub-dean, the bishop of Lincoln his chancellor, and the bishop of Rochester his chaplain. This see hath yielded to the church 18 saints; to the church of Rome, 9 cardinals; to the civil state of England 12 lord chancellors, 4 lord treasurers, and 1 lord chief justice; and 9 chancellors to the University of Oxford. To this see belongs only one archdeacon, viz. of Canterbury. To the cathedral belongs an archbishop, a dean, a chancellor, an archdeacon, 12 prebends, 6 preachers, 6 minor canons, 6 substitutes, 12 lay clerks, 10 choristers, 2 masters, 50 scholars, and 12 almsmen.



CANTERBURY-*Bell*, in botany: The English name of a species of CAMPANULA.

CANTERUS, (William) an eminent linguist and philologer, was born at Utrecht, in 1542. He studied at Louvain and Paris; and gave surprising proofs of his progress in Greek and Latin literature. He afterwards visited the several universities of Germany and Italy; and died at Louvain, in 1575, aged 33. He understood six languages, besides that of his native country; and, notwithstanding his dying so young, wrote several philological and critical works, among which are, *Notæ, Scholia, Emendationes, et Explicationes, in Euripidem, Sophoclem, Æschylum, Ciceronem, Propertium, Ausonium*, &c. and many translations of Greek authors.

CANTHARIDES. See CANTHARIS and MELOE.

CANTHARIS, in zoology, a genus of insects belonging to the order of insecta coleoptera. The feelers of this genus are setaceous; the breast is marginated, and shorter than the head; the elytra, or wing-cases, are flexile; and the sides of the belly are plated and papillous. Linnæus enumerates 27 species of the cantharis, most of them to be found in different parts of Europe. The cantharis used in making blistering plasters, is ranked under a different genus, *viz.* the MELOE.

CANTHI, in anatomy, cavities at the extremities of the eye-lids, commonly called the *corners of the eye*: the greater of them, or the greater canthus, is next the nose; the lesser of them, or the little canthus, lies towards the temple.

CANTICLES, a canonical book of the Old Testament, otherwise called the *Song of Solomon*; by the Jews the *Song of Songs, Canticum Canticorum*. The book of Canticles is usually supposed to be an epithalamium composed by Solomon, on occasion of his marriage with the king of Egypt's daughter. But those who penetrate further into the mystery, find in it the marriage of Jesus Christ with human nature, the church, and good men. On this principle the Canticles is held to be a continued allegory, wherein, under the terms of a common wedding, a divine and spiritual marriage is expressed. This song contains the adventures of seven days and seven nights; the exact time allowed for the celebration of marriage among the Hebrews. The Jews themselves, apprehending the book liable to be understood in a gross and carnal manner, prohibited the reading of it before the age of 30, and the same usage anciently obtained in the Christian church. Among the ancients, Theodore Mopsuetanus rejected the book of Canticles as not divine. Divers rabbins have also questioned its being written by inspiration. It is alleged, that the name of God is not once found in it. Mr Whiston has a discourse express to prove that the Canticles is not a sacred book of the Old Testament. He alleges it indeed to have been written by king Solomon the son of David; but asserts that it was composed at the time when that prince, blinded by his concubines, was sunk in lust and idolatry

try. This he chiefly infers from the general character of vanity and diſſoluteneſs which reigns thro' the Canticles; in which there is not, according to Whiſton one thought that leads the mind towards religion, but all is worldly and carnal, to ſay no worſe. For the myſtic ſenſe, he aſſerts it to be without foundation; and that the book is not cited as canonical by any writer before the deſtruction of Jeruſalem. Mr Whiſton will have it to have been taken into the canon between the years 77 and 128, when allegories came into vogue, and the rabbins began to corrupt the text of Scripture. Grotius, Nierembergius, the Dutch divines who criticiſed F. Simon, Menetrier, Baſnage, and ſome others, ſeem alſo to take the Canticles for a profane compoſition, on a footing with the love-pieces of Catullus or Ovid. But this opinion is refuted by Michaelis, Majus, Witſius, Nat. Alexander, Outrein, Francius, and others. Mr Whiſton's arguments have been particularly conſidered by Itchener, and alſo by Dr Gill. R. Akiba finds the book of Canticles more divine than the reſt: the whole world, according to this rabbin, is not worth that day when the Canticles was given to Iſrael; for, whereas all the hagiographers are holy, the Canticles is the holy of holies.

CANTIMARONS, or CATIMARONS, a kind of floats or rafts, uſed by the inhabitants of the coaſt of Coromandel to go a fiſhing in, and to trade along the coaſt. They are made of three or four ſmall canoes, or trunks of trees dug hollow, and tied together with cacao ropes, with a triangular ſail in the middle, made of matts. The perſons who manage them are almoſt half in the water, there being only a place in the middle a little raiſed to hold their merchandize; which laſt particular is only to be underſtood of the trading cantimarons, and not of thoſe who go fiſhing.

CANTIN, (Cape) a promontory of the coaſt of Morocco in Africa, ſituated in W. Long. 10. 2. N. Lat. 33. 9.

CANTING, a ſea-phraſe, denotes the act of turning any thing about.

CANTING *Language*, or *dialect*, is a myſterious ſort of jargon uſed by gypſies, thieves, and ſtrolling beggars, to expreſs their ſentiments to each other, without being underſtood by the reſt of mankind. This dialect is not founded on any rules: yet, even out of that irregularity many words ſeem to retain ſomething of ſcholarſhip; as *togeman*, a gown, from *toga* in the Latin; *pannam*, bread, from *panis*; *caſan*, cheeſe, from *caſeus*, &c. It is obſervable, that, even unknown to ourſelves, we have adopted ſome of their terms into our vulgar language; as *bite* and *bilk*, to cheat; *bounce*, to vapour; *bowſe*, ſtrong drink; *filch*, to ſteal; *flog*, to whip; *rig*, game or ridicule; *roaſt*, to rally; *rhino*, money. From the ſame ſource proceed the words *ſham*, *banter*, *bubble*, *bully*, *ſharper*, *cutting*, *ſhuffling*, *palming*, &c. An anonymous author has given a canting dictionary, comprehending all the terms uſed by the ſeveral tribes of gypſies, beggars, ſhoplifters, highwaymen, foot-pads, and other clans of cheats and villains, with a collection of ſongs in the canting dialect; London, 1725, 8vo.

CANTIUM, (anc. geog.) a promontory of Britain, literally denoting a head land; giving name to a territory called Cantium, now Kent; and to a people called Cantii, (Cæſar), commended for their great humanity and politeneſs. The promontory now the North *Foreland*. It is ſuppoſed that this was the firſt diſtrict in Britain which received a colony from the continent; and that it had frequently changed its maſters, by new colonies coming over from time to time, and driving the inhabitants further north. In the midſt of all theſe revolutions it ſtill retained its ancient name (which was ſo agreeable to its ſhape and ſituation), and gave the ſame name to all the ſucceſſive tribes by which it was inhabited. Thoſe who poſſeſſed it at the time of the firſt Roman invaſion were evidently of Belgic origin, and had come over ſo lately, that they differed in nothing from their countrymen on the continent. "The inhabitants of Kent (ſays Cæſar) are the moſt civilized of all the Britons, amd differ but very little in their manners from the Gauls." This great reſemblance between the people of Kent and their neighbours on the continent, might be partly owing to the ſituation of their country, which being neareſt to the continent, was moſt frequented by ſtrangers from thence. It was this ſituation alſo which expoſed them to the firſt aſſaults of the Romans. For Cæſar, in both his expeditions into Britain, landed in Kent; and therefore we may conclude, that the Cantii had a great ſhare in the vigorous oppoſition that was made to his landing, and in the ſeveral battles and ſkirmiſhes which were fought againſt him after his landing; particularly, they made a very bold, but unſucceſsful attempt, upon his naval camp. The Cantii did not make the ſame vigorous reſiſtance to the Romans on their next invaſion in the reign of Claudius. For Aulus Plautius, the Roman general in that expedition, traverſed their country without ſeeing an enemy; and as they now ſubmitted to the power of Rome without a ſtruggle, ſo they continued in a ſtate of quiet ſubmiſſion to it to the very laſt. The ſituation of Cantium occaſioned its being much frequented by the Romans, who generally took their way through it in their marches to and from the continent. Few places in Britain are more frequently mentioned by the Roman writers than Rutupium and Portus Rutupenſis, moſt probably Richborough and Stonar. Rutupium was the ſame in thoſe times that Dover is now: the uſual place of embarking for, and landing from, the continent. Before the final departure of the Romans out of Britain, Portus Dubris, now Dover, had become a conſiderable place, and a well frequented harbour, where the third iter of Antoninus ends, and from whence they often embarked for Gaul. Portus Lemanus, ſuppoſed to be Lime near Weſt Hythe, was alſo a noted ſea-port in theſe times, and the termination of the fourth iter of Antoninus. Durobrivæ and Durovernum, now Rocheſter and Canterbury, were both Roman towns and ſtations, and are often mentioned in the itinerary and other books. Beſides theſe, there were ſeveral other Roman ſtations, towns, and ports in Cantium, which need not be particular enumerated here. Cantium, in the moſt perfect ſtate of the Roman government, made a part of the province which was called Flavia Cæſarienſis.



CANTO denotes a part or diviſion of a poem, anſwering to what is otherwiſe called a *book*. The word is Italian, where it properly ſignifies *ſong*. Taſſo, Arioſto, and ſeveral other Italians, have divided their longer or heroic poems into cantos. In imitation of them, Scarron

Scarron has also divided his *Gigantomachia*, and Boileau his *Lutrin*, into chants or songs. The like usage has been adopted by some English writers, as Butler, who divides his Hudibras, and Dr Garth his Dispensary, into cantos. A late translator of part of Virgil's Æneid has even subdivided a book of Virgil into several cantos.

Canto, in the Italian music, signifies a *song*: hence *canto simplice* is where all the notes or figures are equal, and called also *canto fermo*; *canto figurato*, that where the figures are unequal, and express different motions.

Canto also signifies the treble part of a song: hence *canto concertante*, the treble of the little chorus; *canto ripieno*, the treble of the grand chorus, or that which sings only now and then in particular places. *Canto* signifies the first treble, unless some other word be added to it, as *secondo*; in which case it denotes the second treble.

CANTON, in geography, denotes a small district or country constituting a distinct government: such are the cantons of Switzerland.

Canton, *Quang-tong*, or Koanton, one of the southern provinces of China; bounded on the north-east by Fokien, on the north by Kiang-si, on the west by Quang-si and the kingdom of Tonking, and every where else by the sea. The country is diversified with hills and plains, and the soil in general so fertile that it produces two crops annually. Besides many of the fruits of Europe, and those common in other parts of the Indies, the province of Canton produces some peculiar to itself. Abundance of valuable aromatic woods are also to be met with in this province, as well as eagle-wood, ebony, &c.; and in the mineral kingdom the province furnishes gold, precious stones, tin, quicksilver, and copper. Silk and sugar are also cultivated here, and pearls are fished up on the coasts; so that every thing which can contribute to the pleasure or convenience of life is to be met with in Canton. "One begins (says F. Premare) to have an idea of China, on entering the river Canton. Both sides of it present large fields of rice which resemble green meadows, and extend beyond the reach of sight. They are intersected by an infinite number of small canals, in such a manner that the barks which pass and repass in them seem at a distance, while the water which carries them is concealed, to glide along the grass. Farther inland the country appears covered with trees and cultivated along the valleys; and the whole scene is interspersed with villages, rural seats, and such a variety of delightful prospects, that one is never tired of viewing them, and regrets to be obliged to pass them so quickly.

All the coasts of this province abound with fish, and furnish vast numbers of crabs, oysters, and tortoises of an immense size. The inhabitants keep a prodigious number of tame ducks, which they hatch in ovens or dunghills, though it does not appear that they borrowed this custom from the Egyptians. The docility of these creatures exceeds what we should be apt at first to imagine. The inhabitants load a number of small barks with them, and carry them in flocks to feed on the sea-shore, where they find shrimps and other animals proper for their nourishment. But though the ducks from the different barks are thus unavoidably mixed together in the day-time, they are easily collected by only beating on a bason, on which they immediately collect themselves into different flocks, and each returns to its proper bark.



In this province the Chinese have also a method of preserving not only the flesh of their ducks in such a manner that it loses nothing of its original flavour, but their eggs also. The latter operation is performed by covering the eggs with a coat of clay mixed with salt. When mixed in this manner, it seems that the salt has the property of penetrating through the pores of the shell, and thus impregnating the substance in the egg, which it could not do by simple solution of water.

Canton, though it suffered much in the Chinese wars, is at present one of the most flourishing provinces of the empire; and being at a great distance from court, its government is one of the most important. A great number of fortresses, many of which are cities provided with numerous garrisons, have been built along the coasts for the suppression of pirates and robbers; for which purpose also a certain number of troops are kept properly posted in different parts of the province. It is divided into ten districts, which contain as many cities of the first class, and 84 of the second and third. The air in general is warm but healthy, and the people are very industrious. They possess in an eminent degree the talent of imitation, so that if they are only shown any European work they can execute others like it with surprising exactness. The most remarkable cities in the province besides Canton the capital are, 1. Chao-tcheou fou, chiefly noted for a monastery of the bonzes in its neighbourhood, to which the adjacent country belongs, and the origin of which is traced back for 8 or 900 years. It has under its jurisdiction six cities of the third class; near one of these grows a reed of which several instruments are made, which cannot be distinguished from real ebony. The air of Chao-tcheou-fou, however, is unhealthy; and great numbers of the inhabitants are carried off annually by contagious distempers, which prevail from the middle of October to the beginning of December. 2. Kao-tcheou-fou, situated in a delightful and plentiful country. In the neighbourhood is found a singular kind of stone much resembling marble, on which are natural representations of rivers, mountains, landscapes, and trees. These stones are cut into slabs, and made into tables, &c. Crabs are also caught on the coasts here, which very much resemble those of Europe; but, says M. Grosier, they have this singularity, that when taken out of the water, they become petrified without losing any thing of their natural figure. 3. Kiun-tcheou-fou, the capital of the island of Hai-nan. See Hai-nan.

Canton, a large, populous, and wealthy city of China, capital of the province of that name, stands on the banks of the river Taa, or great river, which, near the city, is wide and spacious. The wall of the city is pretty high, and about six or seven miles in circumference, though not more than one-third of the ground is occupied by buildings, the other parts being appropriated to pleasure grounds or to fish-ponds. The country is extremely pleasant, and towards the east hilly, so as to command a beautiful prospect of the city and subsurbs, the compass of which, together, is about ten miles.

The buildings of Canton are in general low, consisting of one story and a ground flour, which is covered with earth or red tiles in order to keep it cool; but the houses

Canton. of the moſt reſpectable merchants and mandarins are comparatively lofty and well built. In different parts of the city and ſuburbs are joſs houſes or temples, in which are placed the images worſhipped by the Chineſe; before whom are placed, at particular ſeaſons, a vaſt variety of ſweetmeats, oranges, great plenty of food ready dreſſed, and alſo incenſe, which is kept perpetually burning.

The ſtreets of Canton are long and narrow, paved with flat ſtones, adorned at intervals with triumphal arches, which have a pleaſing effect, and much crowded with people. On both ſides are ſhops as in London, appropriated to the ſale of different commodities; and a kind of awning is extended from houſe to houſe, which prevents the ſun's rays from incommoding either inhabitants or paſſengers. At the end of every ſtreet is a barrier, which, with the gates of the city, are ſhut in the evening. In China Street, which is pretty long and conſiderably wider than the reſt, reſide merchants; whoſe trade, ſo far as reſpects China, lackered ware, fans, &c. is wholly confined to Europeans. Moſt of them ſpeak the foreign languages tolerably well, or at leaſt ſufficiently intelligible to tranſact buſineſs. Beſides theſe merchants, there is a company of twelve or thirteen, called the *Cohong;* who have an excluſive right by appointment from authority to purchaſe the cargoes from the different ſhips, and alſo to ſupply them with teas, raw ſilks, &c. in return. The eſtabliſhment of the Cohong, though injurious to private trade, is admirably well adapted for the ſecurity of the different companies with which they traffic; becauſe each individual becomes a guarantee for the whole: ſo that if one fail, the others conſider themſelves as reſponſible.

In Canton there are no carriages; all burdens are carried by porters acroſs their ſhoulders on bamboos; as are alſo the principal people in ſedan chairs, and the ladies always. The ſtreets of Canton may be traverſed from morning till evening without ſeeing a woman, thoſe excepted who are Tartars, and even theſe but very ſeldom.

On the wharf of the river, which is commodious and pleaſant, ſtand the factories of the different European nations, viz. the Dutch, French, Swedes, Danes, Engliſh, &c. In thoſe reſide the ſupercargoes belonging to their reſpective companies, who are appointed to diſpoſe of the cargoes brought to market; to ſupply the ſhips with others for Europe in return; and, during their abſence, to contract with the merchants for ſuch articles as may be judged neceſſary for the next fleet. Between the reſidents of the factories the moſt perfect cordiality ſubſiſts; in each a common and ſplendid table is kept at the company's expence, and viſits are reciprocally exchanged; ſo that nothing is wanting to make reſidence at Canton agreeable to an European, but the pleaſure naturally reſulting from the ſociety of women.

The ſide of the river next the city is covered with boats, which form a kind of town or ſtreets, in which live the poorer ſort of the Chineſe, or rather the deſcendants of the Tartars. Some of the men come on ſhore in the morning to their reſpective employments, and in thoſe ſampans or boats which are not ſtationary, the women and alſo the men carry paſſengers from place to place in the ſame manner as is done by wherries on the Thames. On this river live many thouſand ſouls who never were permitted to come on ſhore; whoſe only habitation is their boat; in which they eat, drink, ſleep, carry on many occupations, keep ducks, &c. and occaſionally a hog. Canton.

The manufactures of Canton are principally carried on in the ſuburbs; though it has been frequently ſuppoſed that they were confined to the city; and this, by ſome writers, has been given as a reaſon why Europeans are not permitted to enter within the gates. But this is a miſtake; and perhaps the true reaſon for this very ſingular reſtraint is, that the houſes in which they keep their women are chiefly within the city.

At Wampoa, a large commodious place for anchorage, and which is about 12 or 14 miles from Canton, the European veſſels lie and unload their cargoes, which are tranſmitted by lighters to the factories; and by the ſame conveyance receive their reſpective freights. Between this place and the city are three hoppo, or cuſtom-houſes, at which the boats paſſing and repaſſing are obliged to ſtop, and undergo with its paſſengers an examination, in order to prevent ſmuggling. The lighters juſt mentioned, and alſo the captain's pinnace, are, however, excepted; the former having proper officers on board for the purpoſe, and the latter being narrowly watched and examined at the landing.

The weather at Canton is, in ſummer, extremely hot; and in the months of December, January, and February, cold: the country is neverthleſs pleaſant and healthful, abounding with all the neceſſaries and delicacies of life, which may be procured on terms much cheaper than in Europe. The number of inhabitants has been eſtimated at one million; but later calculations have made the number conſiderably leſs. N. Lat. 23. 30. E. Long. 113. 20.

CANTON, (John) an ingenious natural philoſopher, was born at Stroud, in Glouceſterſhire, in 1718; and was placed, when young, under the care of a Mr Davis, of the ſame place, a very able mathematician, with whom, before he had attained the age of nine years, he had gone through both vulgar and decimal arithmetic. He then proceeded to the mathematics, and particularly to algebra and aſtronomy, wherein he had made a conſiderable progreſs, when his father took him from ſchool, and put him to learn his own buſineſs, which was that of a broad cloth weaver. This circumſtance was not able to damp his zeal for the acquiſition of knowledge. All his leiſure time was devoted to the aſſiduous cultivation of aſtronomical ſcience; and, by the help of the Caroline tables, annexed to "Wing's Aſtronomy," he computed eclipſes of the moon and other phænomena. His acquaintance with that ſcience he applied likewiſe to the conſtructing of ſeveral kinds of dials. But the ſtudies of our young philoſopher being frequently purſued to very late hours, his father, fearing that they would injure his health, forbad him the uſe of a candle in his chamber any longer than for the purpoſe of going to bed; and would himſelf often ſee that his injunction was obeyed. The ſon's thirſt of knowledge was, however, ſo great, that it made him attempt to evade the prohibition, and to find means of ſecreting his light till the family had retired to reſt, when he roſe to proſecute undiſturbed his favourite purſuits. It was during this prohibition, and at theſe hours, Canton. hours, that he computed, and cut upon ſtone, with no better an inſtrument than a common knife, the lines of a large upright ſun-dial, on which, beſides the hour of the day, was ſhown the riſing of the ſun, his place in the ecliptic, and ſome other particulars. When this was finiſhed, and made known to his father, he permitted it to be placed in the front of his houſe, where it excited the admiration of ſeveral gentlemen in the neighbourhood, and introduced young Mr Canton to their acquaintance, which was followed by the offer of the uſe of their libraries. In the library of one of theſe gentlemen, he found "Martin's Philoſophical Grammar," which was the firſt book that gave him a taſte for natural philoſophy. In the poſſeſſion of another gentleman, a few miles from Stroud, he firſt ſaw a pair of globes; an object that afforded him uncommon pleaſure, from the great eaſe with which he could ſolve thoſe problems he had hitherto been accuſtomed to compute. The dial was beautified a few years ago at the expence of the gentlemen at Stroud, ſeveral of whom had been his ſchool-fellows, and who continued ſtill to regard it as a very diſtinguiſhed performance. Among other perſons with whom he became acquainted in early life, was the late reverend and ingenious Dr Henry Miles of Tooting, a learned and reſpectable member of the Royal Society, and of approved eminence in natural knowledge. This gentleman, perceiving that Mr Canton poſſeſſed abilities too promiſing to be confined within the narrow limits of a country town, prevailed on his farther to permit him to come to London. Accordingly he arrived at the metropolis March 4, 1737, and reſided with Dr Miles at Tooting till the 6th of May following; when he articled himſelf, for the term of five years, as a clerk to Mr Samuel Watkins, maſter of the academy in Spital-ſquare. In this ſituation, his ingenuity, diligence, and good conduct, were ſo well diſplayed, that on the expiration of his clerkſhip in May 1742, he was taken into partnerſhip with Mr Watkins for three years; which gentleman he afterwards ſucceeded in Spital-ſquare, and there continued during his whole life. In 1744, he married Penelope, the eldeſt daughter of Mr Thomas Colbrooke, and niece to James Colbrooke, Eſq; banker in London.

Towards the end of 1745, electricity, which ſeems early to have engaged Mr Canton's notice, received a very capital improvement by the diſcovery of the famous Leyden Phial. This event turned the thoughts of moſt of the philoſophers of Europe to that branch of natural philoſophy; and our author, who was one of the firſt to repeat and to purſue the experiment, found his aſſiduity and attention rewarded by many capital diſcoveries. Towards the end of 1749, he was concerned with his friend, the late Mr Benjamin Robins, in making experiments in order to determine to what height rockets may be made to aſcend, and at what diſtance their light may be ſeen. In 1750 was read at the Royal Society, Mr Canton's "Method of making artificial magnets, without the uſe of, and yet far ſuperior to, any natural ones." This paper procured him the honour of being elected a member of the Society, and the preſent of their gold medal. The ſame year he was complimented with the degree of M. A. by the univerſity of Aberdeen; and, in 1751, was choſen one of the council of the Royal Society.

In 1752, our philoſopher was ſo fortunate as to be the firſt perſon in England, who, by attracting the electric fire from the clouds during a thunder-ſtorm, verified Dr Franklin's hypotheſis of the ſimilarity of lightning and electricity. Next year, his paper intitled, "Electrical Experiments, with an attempt to account for their ſeveral Phænomena," was read at the Royal Society. In the ſame paper Mr Canton mentioned his having diſcovered, by a great number of experiments, that ſome clouds were in a poſitive, and ſome in a negative, ſtate of electricity. Dr Franklin, much about the ſame time, made the like diſcovery in America. This circumſtance, together with our author's conſtant defence of the doctor's hypotheſis, induced that excellent philoſopher, immediately on his arrival in England, to pay Mr Canton a viſit, and gave riſe to a friendſhip which ever after continued without interruption or dimunition. In the "Lady's Diary for 1756," our author anſwered the prize queſtion that had been propoſed in the preceding year. The queſtion was, "How can what we call the ſhooting of ſtars be beſt accounted for; what is the ſubſtance of this phænomenon; and in what ſtate of the atmoſphere doth it moſt frequently ſhow itſelf?" The ſolution, though anonymous, was ſo ſatisfactory to his friend, Mr Thomas Simpſon, who then conducted that work, that he ſent Mr Canton the prize, accompanied with a note, in which he ſaid, he was ſure that he was not miſtaken in the author of it, as no one beſides, that he knew of, could have anſwered the queſtion. Our philoſopher's next communication to the public, was a letter in the "Gentleman's Magazine for September 1759," on the electrical properties of the tourmalin, in which the laws of that wonderful ſtone are laid down in a very conciſe and elegant manner. On December 13th, in the ſame year, was read at the Royal Society, "An attempt to account for the regular diurnal variation of the Horizontal Magnetic Needle; and alſo for its irregular variation at the time of an Aurora Borealis." A complete year's obſervations of the diurnal variations of the needle are annexed to the paper. On Nov. 5, 1761, our author communicated to the Royal Society an account of the Tranſit of Venus, June 6, 1761, obſerved in Spital-ſquare. Mr Canton's next communication to the Society, was a letter addreſſed to Dr Benjamin Franklin, and read Feb. 4, 1762, containing ſome remarks on Mr Delaval's electrical experiments. On Dec. 16, in the ſame year, another curious addition was made by him to philoſophical knowledge, in a paper, intitled, "Experiments to prove that water is not incompreſſible." Theſe experiments are a complete refutation of the famous Florentine experiment which ſo many philoſophers have mentioned as a proof of the incompreſſibility of water. On St Andrew's day 1763, our author was the third time elected one of the council of the Royal Society; and on Nov. 8, in the following year, were read, before that learned body, his farther "Experiments and obſervations on the compreſſibility of water, and ſome other fluids." The eſtabliſhment of this fact, in oppoſition to the received opinion, formed on the haſty deciſion of the Florentine academy, was thought to be deſerving of the Society's gold medal. It was accordingly moved for in the council of 1764; and after ſeveral invidious delays, which terminated Canton.

much

much to the honour of Mr Canton, it was presented to him November 30, 1765.

The next communication of our ingenious author to the Royal Society, which we shall take notice of in this place, was on Dec. 22, 1768, being "An easy method of making a Phosphorus that will imbibe and emit light like the Bolognian stone; with experiments and observations." When he first showed to Dr Franklin the instantaneous light acquired by some of this phosphorus from the near discharge of an electrified bottle, the doctor immediately exclaimed, "And God said, let there be light, and there was light." The dean and chapter of St Paul's having, in a letter to the president, dated March 6, 1769, requested the opinion of the Royal Society relative to the best and most effectual method of fixing electrical conductors to preserve that cathedral from damage by lightning, Mr Canton was one of the committee appointed to take the letter into consideration, and to report their opinion upon it. The gentlemen joined with him in this business were, Dr Watson, Dr Franklin, Mr Delaval, and Mr Wilson. Their report was made on the 8th of June following; and the mode recommended by them has been carried into execution. The last paper of our author's, which was read before the Royal Society, was on Dec. 21, 1769; and contained "Experiments to prove that the Luminousness of the Sea arises from the putrefaction of its animal substances." In the account now given of his communications to the public, we have chiefly confined ourselves to such as were the most important, and which threw new and distinguished light on various objects in the philosophical world. Besides these, he wrote a number of papers, both in earlier and in later life, which appeared in several different publications, and particularly in the Gentleman's Magazine.

The close and sedentary life of Mr Canton, arising from an unremitted attention to the duties of his profession, and to the prosecution of his philosophical enquiries and experiments, probably contributed to shorten his days. The disorder into which he fell, and which carried him off, was a dropsy. His death happened on March 22, 1772, in the 54th year of his age.

CANTONING, in the military art, is the allotting distinct and separate quarters to each regiment; the town where they are quartered being divided into as many cantons as there are regiments.

CANTRED, or CANTREF, signifies an hundred villages. It is a British word, compounded of the adjective *cant*, i. e. hundred; and *tref*, a town or village. In Wales some of the counties are divided into cantreds, as in England into hundreds.

CANTYRE, (from *Cantierre*, signifying a "headland); the southern division of the shire of Argyle in Scotland. It is a peninsula, stretching 37 miles from north to south, and seven miles in breadth. It is mostly plain, arable, and populous; inhabited promiscuously by Highlanders and Lowlanders; the latter being invited to settle in this place by the Argyle family, that the lands might be the better cultivated. It gives the title of *marquis* to the duke, and is by Lochfyn divided from Argyle Proper. This loch is an inlet from the sea, about 60 miles in length and four in breadth, affording heretofore an excellent herring-fishery. There are many paltry villages in this country, but no town of any consequence except Campbeltown.



Cantyre was granted to the house of Argyle after a suppression of a rebellion of the Macdonalds of the Isles (and it is supposed of this peninsula) in the beginning of the last century, and the grant was afterwards ratified by parliament. The ancient inhabitants were the Mac-donalds, Mac-eachrans, Mac-kays, and Mac-maths.

*Mull of* CANTYRE, the south cape or promontory of the peninsula. There is here a light-house 235 feet above the sea at high-water, situated on the rocks called the *Merchants*, Lat. 55. 22. Long. 5. 42. west of London. The sound of Isla from the light-house bearing, by the compass, N. by E. distant 27 miles; the south end of Isla N. N. W. distant 25 miles; the north end of Rathlin island, N. W. by W. one half W.; the Maiden Rocks, S. by W. one half W. distant 14 miles; Copland light, S. by W. one half W. distant 31 miles. The lanthorn is seen from N. N. E. 1-4th E. from S. by W. 1-4th W. and intermediate points of the compass N. of those two points.

CANTZ, a town of Silesia in Germany. E. Long. 16. 36. N. Lat. 51. 6.

CANVAS, in commerce, a very clear unbleached cloth of hemp, or flax, wove regularly in little squares. It is used for working tapestry with the needle, by passing the threads of gold, silver, silk, or wool, through the intervals or squares.

CANVAS is also a coarse cloth of hemp, unbleached, somewhat clear, which serves to cover women's stays, also to stiffen men's clothes, and to make some other of their wearing apparel, &c.

CANVAS is also used among the French for the model or first words whereon an air or piece of music is composed, and given to a poet to regulate and finish. The canvas of a song contains certain notes of the composer, which show the poet the measure of the verses he is to make. Thus Du Lot says, he has canvas for ten sonnets against the muses.

CANVAS is also the name of a cloth made of hemp, and used for ship-sails.

CANVAS, among painters, is the cloth on which they usually draw their pictures; the canvas being smoothed over with a slick-stone, then sized, and afterwards whited over, makes what the painters call their *primed cloth*, on which they draw their first sketches with coal or chalk, and afterwards finish with colours.

CANUSIUM, (anc. geog.) a town of Apulia, on the right or south side of the Aufidus, to the west of Cannæ; whether the Romans fled after the defeat sustained there. It was famous for its red shining wool; whence those who wore clothes made of it were called *Canusinati*. Now called CANOSA; which see.

CANUTE, the first Danish king of England after Ironside. He married Emma widow of king Ethelred; and put to death several persons of quality who stood in his way to the crown. Having thus settled his power in England, he made a voyage to his other kingdom of Denmark, in order to resist the attacks of the king of Sweden; and he carried along with him a great body of the English under the command of the earl of Godwin. This nobleman had here an opportunity of performing a service by which he both reconciled the

Canute.

king's mind to the English nation, and, gaining to himself the friendship of his sovereign, laid the foundation of that immense fortune which he acquired to his family. He was stationed next the Swedish camp; and, observing a favourable opportunity which he was obliged suddenly to seize, he attacked the enemy in the night, drove them suddenly from their trenches, threw them into disorder, pursued his advantage, and obtained a decisive victory over them. Next morning, Canute, seeing the English camp entirely abandoned, imagined that these disaffected troops had deserted to the enemy; and he was agreeably surprised to find that they were at that time engaged in pursuit of the discomfited Swedes. He was so pleased with this success, and the manner of obtaining it, that he bestowed his daughter in marriage upon Godwin, and treated him ever after with the most entire confidence and regard.

In another voyage which he afterwards made to Denmark, Canute attacked Norway, and expelled the just but unwarlike Olaus from his kingdom, of which he kept possession till the death of that prince. He had now by his conquests and valour attained the utmost height of his ambition; and having leisure from wars and intrigues, he felt the unsatisfactory nature of all human enjoyments; and, equally weary of the glory and turmoils of this life, he began to cast his view towards that future existence which is so natural for the human mind, whether satiated by prosperity or disgusted with adversity, to make the object of its attention. Unfortunately the spirit which prevailed in that age gave a wrong direction to his devotion; and, instead of making atonement to those whom he had formerly injured by his acts of violence, he entirely employed himself in those exercises of piety which the monks represented as most meritorious. He built churches; he endowed monasteries; he enriched ecclesiastics; and he bestowed revenues for the support of chantries at Assington and other places, where he appointed prayers to be said for the souls of those who had there fallen in battle against him. He even undertook a pilgrimage to Rome, where he sojourned a considerable time; and, besides obtaining from the Pope some privileges for the English school erected there, he engaged all the princes through whose dominions he was obliged to pass, to desist from those heavy impositions and tolls which they were accustomed to exact from the English pilgrims. By this spirit of devotion, no less than by his equitable and politic administration, he gained in a good measure the affections of his subjects.

Canute, who was the greatest and most powerful prince of his time, sovereign of Denmark and Norway as well as of England, could not fail to meet with adulation from his courtiers; a tribute which is liberally paid even to the meanest and weakest of princes. Some of his flatterers breaking out one day in admiration of his grandeur, exclaimed, that every thing was possible for him: upon which the monarch, it is said, ordered a chair to be set on the sea-shore while the tide was making; and, as the waters approached, he commanded them to retire, and to obey the voice of him who was lord of the ocean. He feigned to sit some time in expectation of their submission; but when the sea still advanced towards him, and began to wash him with its billows, he turned to his courtiers, and remarked to them, That every creature in the universe was feeble and impotent, and that power resided with one Being alone, in whose hands were all the elements of nature, who could say to the ocean, "Thus far shalt thou go, and no farther," and who could level with his nod the most towering piles of human pride and ambition. From that time, it is said, he never would wear a crown. He died in the 20th year of his reign; and was interred at Winchester, in the old monastery.

Canzone || Caoutchouc.

CANZONE, in music, signifies, in general, a song, where some little fugues are introduced: but it is sometimes used for a sort of Italian poem, usually pretty long, to which music may be composed in the style of a cantata. If this term be added to a piece of instrumental music, it signifies much the same as cantata: if placed in any part of a sonata, it implies the same meaning as *allegro*, and only denotes that the part to which it is prefixed is to be played or sung in a brisk and lively manner.

CANZONETTA, a diminutive of canzone, denoting a little short song. The canzonette neapolitane has two strains, each whereof is sung twice over, as the vaudevilles of the French: The canzonette siciliane is a species of jigg, the measure whereof is usually twelve-eighths, and six-eighths, and sometimes both, as rondeaus.

CAORLO, a small island in the gulf of Venice, on the coast of Friuli, 20 miles south-west of Aquileia, subject to Venice. It has a town of the same name, with a bishop's see.

CAOUTCHOUC, Elastic Resin, or *India Rubber*, a substance produced from the syringe-tree of Cayenne, and other parts of South America, and possessed of the most singular properties. No substance is yet known which is so pliable, and at the same time so elastic; and it is farther a matter of curiosity, as being capable of resisting the action of very powerful menstrua. From the account of M. de la Condamine, we learn, that this substance oozes out, under the form of a vegetable milk, from incisions made in the tree: and that it is gathered chiefly in time of rain, because, though it may be collected at all times, it flows then most abundantly. The means employed to inspissate and indurate it, M. de la Borde says, are kept a profound secret. M. Bomare, and others, affirm, that it thickens and hardens gradually by being exposed to the air; and as soon as it acquires a solid consistence, it manifests a very extraordinary degree of flexibility and elasticity. Accordingly the Indians make boots of it, which water cannot penetrate, and which, when smoked, have the appearance of real leather. Bottles are also made of it, to the necks of which are fastened hollow reeds, so that the liquor contained in them may be squirted through the reeds or pipes by pressure. One of these filled with water is always presented to each of the guests at their entertainments, who never fail to make use of it before eating. This whimsical custom led the Portuguese in that country to call the tree that produces this resin *pao di xirringa*, and hence the name of *seringat* is given both to the tree and to its resinous production. Flambeaux, an inch and a half in diameter, and two feet long, are likewise made of this resin, which give a beautiful light, have no bad smell, and burn twelve hours. A kind of cloth is also prepared from it, which the

Caoutchouc.

the inhabitants of Quito apply to the fame purpofes as our oil-cloth and fail-cloth. It is formed, in fine, by means of moulds, into a variety of figures for ufe and ornament; and the procefs is faid to be thus:—The juice, which is obtained by incifion, is fpread over pieces of clay formed into the defired fhape, and as faft as one layer is dry, another is added, till the veffel be of the proper thicknefs: the whole is then held over a ftrong fmoke of vegetables on fire, whereby it hardens into the texture and appearance of leather; and before the finifhing, while yet foft, is capable of having any impreffion made on the outfide, which remains ever after. When the whole is done, the infide mould is picked out.

Ever fince this refin has been known in Europe, its chemical qualities, and other interefting properties, have been very diligently inveftigated. In particular, it has been endeavoured to difcover fome method of diffolving it in fuch a manner that it would affume different figures with equal eafe as when in its original ftate of milk. In the memoirs of the academy of fciences for 1768, we have an account of feveral attempts for this purpofe, and how it may be effected.—The ftate of vegetable milk in which the caoutchouc refin is found when it comes from the tree, led Mr Macquer to imagine that it was compofed of an oil and a watery matter. From its wanting aromatic flavour, from its little volatility, and from its being incapable of folution in fpirit of wine, he concluded that the oil which entered its compofition was not an effential, but a fatty one. Hence he thought it probable that it paffed from a fluid to a folid form by the evaporation of the watery part, and that the oily folvents would reduce it to a foft ftate. The firft trials he made for diffolving it were with linfeed oil, effence of turpentine, and feveral others. But all he could obtain by means of thefe menftrua was a vifcid fubftance incapable of being hardened, and totally void of elafticity. The rectified effential oil of turpentine was employed feemingly with greater fuccefs. To feparate from this menftruum the caoutchouc which it had diffolved, Mr Macquer added fpirit of wine: but the confequence was, that part only of the oil united with the fpirit; the reft remaining obftinately attached to the refin which it had diffolved, and thus preventing it from affuming a folid confiftence. The author next endeavoured to diffolve it by means of heat in Papin's digefter. But neither water, nor fpirit of wine, although in this way capable of diffolving the hardeft bones, could produce any other effect upon it than to render it more firm than before. After this, he tried what effect the milky juice of other vegetables would have upon it. He ufed feveral kinds, particularly that of the fig. But, in this way, he could obtain no folution. From the great volatility of ether, he was next induced to try it as a menftruum; and, for this purpofe, he prepared fome with great attention. The caoutchouc, cut into little bits, and put into a proper veffel with as much ether as was fufficient to cover it, was perfectly diffolved without any other heat than that of the atmofphere. This folution was tranfparent and of an amber colour. It ftill preferved the fmell of ether, but mixed with the difagreeable odour of the caoutchouc, and it was little lefs fluid than pure ether. Upon its being thrown into water, no milky liquor was produced; but there arofe to the furface a folid membrane which poffeffed the great elafticity and other peculiar properties of the caoutchouc. He obferves, however, that two pints of the beft ether, obtained by rectifying eight or ten points of the common ether by a gentle heat, muft be ufed, in order to the fuccefs of the operation.—The diftinguifhing properties of this fubftance, viz. its folidity, flexibility, and elafticity, and its quality of refifting the action of aqueous, fpiritous, faline, oily, and other common folvents, render it extremely fit for the conftruction of tubes, catheters, and other inftruments, in which thefe properties are wanted. In order to form this refin into fmall tubes, M. Macquer prepared a folid cylindrical mould of wax, of the defired fize and fhape; and then dipping a pencil into the etherial folution of the refin, daubed the mould over with it, till he had covered it with a coat of refin of a fufficient thicknefs. The whole piece is then thrown into boiling water; by the heat of which the wax is foon melted, and rifes to the furface, leaving the refinous tube completely formed behind.

A refin fimilar to this was fome years ago difcovered by M. Poivre, in the ifle of France; and there are various milky juices extracted from trees in America and elfewhere, which by previous mixtures and preparations are formed into an elaftic refin, but of an inferior quality to that of Cayenne: fuch, for inftance, are the juices obtained from the *Cecropia peltata*, the *Ficus religiofo* and *indica*, &c.

Of the genuine trees, thofe growing along the banks of the river of the Amazons are defcribed by M. Condamine as attaining a very great height, being at the fome time perfectly ftraight, and having no branches except at top, which is but fmall, covering no more than a circumference of ten feet. Its leaves bear fome refemblance to thofe of the *manioc:* they are green on the upper part, and white beneath. The feeds are three in number, and contained in a pod confifting of three cells, not unlike thofe of the *ricinus* or *palma Chrifti;* and in each of them there is a kernel, which being ftripped and boiled in water produces a thick oil or fat, anfwering the purpofes of butter in the cookery of that country.

A method of diffolving this elaftic gum without ether, for the purpofes of a varnifh or the like, is as follows: Take one pound of the fpirit of turpentine, and a pound of the gum cut into very fmall pieces; pour the turpentine into a long-necked matrafs, which muft be placed in a fand-bath; throw in the gum, not all at once, but by little and little according as it is perceived to diffolve: When entirely diffolved, pour into the matrafs a point of nut or linfeed oil, or oil of popies, rendered deficcative in the ufual manner with litharge: Then let the whole boil for a quarter of an hour, and the preparation is finifhed. This would make an excellent varnifh for air-balloons, were it not fo expenfive on account of the price of the gum.—Another method, invented by Mr Baldwin, is as follows. Take any quantity of the caoutchouc, as two ounces avoirdupois: cut it into fmall bits with a pair of fciffars. Put a ftrong iron ladle (fuch as plumbbers or glaziers melt their lead in) over a common pitcoal or other fire. The fire muft be gentle, glowing, and without fmoke. When the ladle is hot, much below a red heat, put a single bit into the ladle. If black smoke issues, it will presently flame and disappear; or it will evaporate without flame: the ladle is then too hot. When the ladle is less hot, put in a second bit, which will produce a white smoke. This white smoke will continue during the operation, and evaporate the caoutchouc: therefore no time is to be lost; but little bits are to be put in, a few at a time, till the whole are melted. It should be continually and gently stirred with an iron or brass spoon. Two pounds, or one quart, of the best drying oil (or of raw linseed oil which, together with a few drops of neats foot oil, has stood a month, or not so long, on a lump of quicklime, to make it more or less drying) is to be put into the melted caoutchouc, and stirred till hot: and the whole poured into a glazed vessel, through a coarse gauze, or fine sieve. When settled and clear, which will be in a few minutes, it is fit for use, either hot or cold.

The Abbé Clavigero informs us, that the elastic gum is called by the Mexicans *Olin* or *Olli*, and by the Spaniards of that kingdom *Ule*: That it distils from the Olquahuitl, which is a tree of moderate size; the trunk of which is smooth and yellowish, the leaves pretty large, the flowers white, and the fruit yellow and rather round, but angular; within which there are kernels as large as filberds, and white, but covered with a yellowish pellicle: That the kernel has a bitter taste, and the fruit always grows attached to the bark of the tree: That when the trunk is cut, the Ule which distils from it is white, liquid, and viscous; afterwards it becomes yellow; and lastly of a leaden colour, though rather blacker, which it always retains. The tree, he adds, is very common in the kingdom of Guatimala.

As to the genus of this tree, it does not seem to be yet ascertained. Aublet, in his *Histoire des Plants de la Guiane* (p. 871.), describes the tree, the fruit, and manner of collecting the juice; but never saw the flower: he calls it, however, *Hevea Guianensis*. In Jacquin's America, it is called *Echites corymbosa*. The younger Linnæus, in his *Supplementum Plantarum* (p. 422), names it *Jatropha elastica;* but acknowledges that he only gives it this name, from the structure of the fruit having most resemblance to that genus, his dry species wanting the flowers.

Of the above gum, it is said, the Chinese make elastic rings for lascivious purposes.—Among us it is used by surgeons for injecting liquids, and by painters for rubbing out black-lead pencil marks, &c.

CAP, a part of dress made to cover the head, much in the figure thereof.

The use of caps and hats is referred to the year 1449, the first seen in these parts of the world being at the entry of Charles VII. into Rouen: from that time they began to take place of the hoods, or chaperoons, that had been used till then. When the cap was of velvet, they called it *mortier;* when of wool, simply *bonnet*. None but kings, princes, and knights, were allowed the use of the mortier. The cap was the head-dress of the clergy and graduates. Pasquier says, that it was anciently a part of the hood worn by the people of the robe; the skirts whereof being cut off as an incumbrance, left the round cap an easy commodious cover for the head; which round cap being afterwards assumed by the people, those of the gown changed it for a square one, first invented by a Frenchman, called Patrouillet: he adds, that the giving of the cap to the students in the universities, was to denote that they had acquired full liberty, and were no longer subject to the rod of their superiors; in imitation of the ancient Romans, who gave a *pileus*, or cap, to their slaves, in the ceremony of making them free: whence the proverb, *Vocare servos ad pileum*. Hence, also, on medals, the cap is the symbol of liberty, whom they represent holding a cap in her right hand, by the point.

The Romans were many ages without any regular covering for the head: when either the rain or sun was troublesome, the lappet of the gown was thrown over the head; and hence it is that all the ancient statues appear bareheaded, excepting sometimes a wreath, or the like. And the same usage obtained among the Greeks, where, at least during the heroic age, no caps were known. The sort of caps or covers of the head in use among the Romans on divers occasions, were the *pitra*, *pileus*, *cucullus*, *galerus*, and *palliolum;* the differences between which are often confounded by ancient as well as modern writers.

The French clergy wear a shallow kind of cap, called *calotte*, which only covers the top of the head, made of leather, sattin, worsted, or other stuff. The red cap is a mark of dignity allowed only to those who are raised to the cardinalate. The secular clergy are distinguished by black leathern caps, the regulars by knit and worsted ones.

Churchmen, and the members of universities, students in law, physic, &c. as well as graduates, wear square caps. In most universities doctors are distinguished by peculiar caps, given them in assuming the doctorate. Wickliff calls the canons of his time *bifurcati*, from the caps. Pasquier observes, that in his time, the caps worn by the churchmen, &c. were called square caps; though, in effect, they were round yellow caps.

The Chinese have not the use of the hat, like us; but wear a cap of a peculiar structure, which the laws of civility will not allow them to put off: it is different for the different seasons of the year: that used in summer is in form of a cone, ending at top in a point. It is made of a very beautiful kind of mat, much valued in that country, and lined with sattin: to this is added, at top, a large lock of red silk, which falls all round as low as the bottom; so that in walking, the silk fluctuating regularly on all sides, makes a graceful appearance: sometimes, instead of silk, they used a kind of bright red hair, the lustre whereof no weather effaces. In winter they wear a plush cap, bordered with martlet's or fox's skin; as to the rest, like those for the summer. These caps are frequently sold for eight or ten crowns: but they are so short, that the ears are exposed.

The cap is sometimes used as a mark of infamy; in Italy the Jews are distinguished by a yellow cap; at Lucca by an orange one. In France, those who had been bankrupts were obliged ever after to wear a green cap, to prevent people from being imposed on in any future commerce. By several arrets in 1584, 1622, 1128, 1688, it was decreed, that if they were at any time found without their green cap, their protection should

ſhould be null, and their creditors impowered to caſt them into priſon: but the ſentence is not now executed.

*Cap of Maintenance*, one of the regalia, or ornaments of ſtate belonging to the kings of England, before whom it was carried at the coronation and other great ſolemnities. Caps of Maintenance are alſo carried before the mayors of the ſeveral cities in England.

Cap, in ſhip building, a ſtrong, thick, block of wood, uſed to confine two maſts together, when one is erected at the head of the other in order to lengthen it. It is for this purpoſe furniſhed with two holes perpendicular to its length and breadth, and parallel to its thickneſs: one of theſe is ſquare, and the other round; the former being ſolidly fixed upon the upper end of the lower maſt, whilſt the latter receives the maſt employed to lengthen it, and ſecures it in this poſition.

CAPACIO, an epiſcopal town of Italy, in the kingdom of Naples, and in the Hither Principato. E. Long. 15. 18. N. Lat. 40. 40.

CAPACITY, in a general ſenſe, an aptitude or diſpoſition to hold or retain any thing.

Capacity, in geometry, is the ſolid contents of any body; alſo our hollow meaſure for wine, beer, corn, ſalt, &c. are called *meaſures of capacity*.

Capacity, in law, the ability of a man, or body politic, to give or take lands or other things, or ſue actions.

Engliſh law allows the king two capacities; a natural, and a political: in the firſt, he may purchaſe lands to him and his heirs; in the ſecond, to him and his ſucceſſors. The clergy of the church of England have the like.

CAPARASON, or Caparison, the covering or clothing laid over an horſe; eſpecially a ſumpter horſe, or horſe of ſtate. The word is Spaniſh, being an augmentative of *cape, caput, head*.

Anciently the caparaſons were a kind of iron armour, wherewith horſes were covered in battle.

CAPE, in geography, an high land running out with a point into the ſea, as Cape-Nord, Cape-Horn, the Cape of Good Hope, &c.

*Cape-Elk*. See Cervus.

*Cape-Breton*. See Breton.

*Cape-Coaſt Caſtle*. See Coast.

*Cape of Good Hope*. See Good Hope.

*Cape-Verd*. See Verd.

CAPELL, (Edward) a gentleman well known by his indefatigable attention to the works of Shakeſpeare, was a native of the county of Suffolk, and received his education at the ſchool of St Edmund's Bury. In the dedication of his edition of Shakeſpeare, in 1768, to the duke of Grafton, he obſerves, that "his father and the grandfather of his grace were friends, and to the patronage of the deceaſed nobleman he owed the leiſure which enabled him to beſtow the attention of 20 years on that work." The office which his grace beſtowed on Mr Capell was that of deputy-inſpector of the plays, to which a ſalary is annexed of 200l. a-year. So early as the year 1745, as Mr Capell himſelf informs us, ſhocked at the licentiouſneſs of Hanmer's plan, he firſt projected an edition of Shakeſpeare, of the ſtricteſt accuracy, to be collated and publiſhed, in due time, *ex fide codicum*. He immediately proceeded to collect and compare the oldeſt and ſcarceſt copies; noting the original excellencies and defects of the rareſt quartos, and diſtinguiſhing the improvements or variations of the firſt, ſecond, and third folios: and, after many years labour, produced a very beautiful ſmall octavo, in 10 volumes, with "an Introduction." There is not, the authors of the Monthly Review obſerve, among the various publications of the preſent literary æra, a more ſingular compoſition than that "Introduction." In ſtyle and manner, it is more obſolete and antique than the age of which it treats. It is Lord Herbert of Cherbury, walking the new pavement in all the trappings of romance; but, like Lord Herbert, it diſplays many valuable qualities accompanying this air of extravagance, much ſound ſenſe, and appropriate erudition. In the title-page of "Mr William Shakeſpeare his Commedies, Hiſtories, and Tragedies," it was alſo announced and promulgated, "Whereunto will be added, in ſome other volumes, notes critical and explanatory, and a body of various readings entire." "The Introduction" likewiſe declared, that theſe "notes and various readings" would be accompanied with another work, diſcloſing the ſources from which Shakeſpeare "drew the greater part of his knowledge in mythological and claſſical matters, his fable, his hiſtory, and even the ſeeming peculiarities of his language—to which," ſays Mr Capell, "we have given for title, The School of Shakeſpeare." Nothing ſurely could be more properly conceived than ſuch deſigns, nor have we ever met with any thing better grounded on the ſubject of "the learning of Shakeſpeare" than what may be found in the long note to this part of Mr Capell's Introduction. It is more ſolid than even the popular "Eſſay" on this topic. Certain quaintneſſes of ſtyle, and peculiarities of printing and punctuation, attended the whole of this publication. The outline, however, was correct; and the critic, with unremitting toil, proceeded in his undertaking. But while he was diving into the claſſics of Caxton (to continue the Reviewers account), and working his way underground, like the river Mole, in order to emerge with all his glories; while he was looking forward to his triumphs; certain other active ſpirits went to work upon his plan, and, digging out the promiſed treaſures, laid them prematurely before the public, defeating the effect of our critic's diſcoveries by anticipation. Steevens, Malone, Farmer, Percy, Reed, and a whole hoſt of literary ferrets, burrowed into every hole and corner of the warren of modern antiquity, and over-ran all the country, whoſe map had been delineated by Edward Capell. Such a contingency nearly ſtaggered the ſteady and unſhaken perſeverance of our critic, at the very eve of the completion of his labours, and as his editor informs us—for, alas! at the end of near 40 years, the publication was poſthumous, and the critic himſelf no more!—he was almoſt determined to lay the work wholly aſide. He perſevered, however, by the encouragement of ſome noble and worthy perſons: and to ſuch their encouragement, and his perſeverance, the public was, in 1783, indebted for three large volumes in 4to, under the title of "Notes and various readings of Shakeſpeare; together with the School of Shakeſpeare, or extracts from divers Engliſh

Books, that were in print in the Author's time; evidently showing from whence his several Fables were taken, and some parcel of his Dialogue. Also farther Extracts, which contribute to a due understanding of his Writings, or give a light to the History of his Life, or to the Dramatic History of his Time. By Edw. Capell."—Besides the works already mentioned, Mr Capell was the editor of a volume of ancient poems called "Prolusions;" and the alteration of "Antony and Cleopatra," as acted at Drury Lane in 1758. He died January 24, 1781.

CAPELLA, in astronomy, a bright fixed star in the left shoulder of the constellation Auriga.

CAPELLE, a town of France, in Picardy, and in the Tierache, eight miles from Guise. It was taken by the Spaniards in 1636; but retaken the year after. E. Long. 3. 59. N. Lat. 49. 58.

CAPELLETS, in farriery. See there, § xxxvi. 4.

CAPELLUS, (Lewis) an eminent French Protestant divine, born at Sedan in Champaigne about the year 1579. He was author of some learned works; but is chiefly known from the controversy he engaged in with the younger Buxtorf concerning the antiquity of Hebrew points, which Capelles undertook to disprove. His *Critica Sacra* was also an elaborate work, and excited some disputes. He died in 1658, having made an abridgement of his life in his work, *De gente Capellori.*

CAPER, in botany. See CAPPARIS.

CAPER also denotes a vessel used by the Dutch for cruising and taking prizes from the enemy; in which sense, caper amounts to the same with privateer. Capers are commonly double-officered, and crowded with hands even beyond the rates of ships of war, because the thing chiefly in view is boarding the enemies.

CAPERNAUM, a city celebrated in the gospels, being the place where Jesus usually resided during the time of his ministry. This city is no where mentioned in the Old Testament under this or any other name like it; and therefore it is not improbable that it was one of those towns which the Jews built after their return from the Babylonish captivity. It stood on the sea-cost, *i. e.* on the coast of the sea of Galilee, in the borders of Zebulon and Nephtalim (Matt. iv. 15.), and consequently towards the upper part thereof. It took its name no doubt from an adjacent spring of great repute for its clear and limpid waters; and which, according to Josephus, was by the natives called *Capernaum.* As this spring might be some inducement to the building the town in the place where it stood, so its being a convenient wafting place from Galilee to any part on the other side of the sea, might be some motive to our Lord for his moving from Nazareth, and making this the place of his most constant residence. Upon this account Capernaum was highly honoured, and said by our Lord himself to be *exalted unto heaven;* but because it made no right use of this signal favour, it drew from him the severe denunciation, that it should *be brought down to hell* (Matt. xi. 23.), which has certainly been verified: for, as Dr Wells observes, so far is it from being the metropolis of all Galilee, as it once was, that it consisted long since of no more than six poor fishermens cottages, and may perhaps be now totally desolate.

CAPEROLANS, a congregation of religious in Italy, so called from Peter Caperole their founder, in the 15th century.

The Milanese and Venetians being at war, the enmity occasioned thereby spread itself to the very cloysters. The superiors of the province of Milan, of minor brothers, which extended itself as far as the territories of the republic of Venice, carried it so haughtily over the Venetians, that those of the covenant of Brescia resolved to shake off a yoke which was grown insupportable to them. The superiors, informed of this, expelled out of the province those whom they considered as the authors of this design; the principal of whom were Peter Caperole, Matthew de Tharvillo and Bonaventure of Brescia. Peter Caperole, a man of an enterprising genius, found means to separate the convents of Brescia, Bergamo, and Cremona, from the province of Milan, and subject them to the conventuals. This occasioned a law-suit between the vicar-general and these convents, which was determined in favour of the latter; and these convents, in 1475, by the authority of Pope Sixtus IV. were erected into a distinct vicariate, under the title of that of *Brescia.* This not satisfying the ambition of Caperole, he obtained, by the interposition of the Doge of Venice, that this vicariate might be erected into a congregation, which was called from him *Caperolans.* This congregation still subsists in Italy, and is composed of 24 convents, situated in Brescia, Bergamo, and Cremona.

CAPERQUIN, a town of Ireland, in the county of Waterford, and province of Munster, situated on the river Blackwater. W. Long. 7. 50. N. Lat. 52. 5.

CAPESTAN, a town of France, in Lower Languedoc, in the diocese of Narbonne, and near the royal canal. E. Long. 3. 5. N. Lat. 43. 35.

CAPH, a Jewish measure of capacity for things estimated by Kimchi at the 30th part of the log, by Arbuthnot at the 16th part of the hin, or 32d of the seah, amounting to five-eighths of an English pint. The caph does not occur in Scripture as the name of any measure.

CAPHAR, a duty which the Turks raise on the Christians who carry or send merchandises from Aleppo to Jerusalem and other places in Syria.

This duty of caphar was first imposed by the Christians themselves, when they were in possession of the Holy Land, for the maintenance of the troops which were planted in difficult passes to observe the Arabs and prevent their incursions. It is still continued, and much increased by the Turks, under pretence of defending the Christians against the Arabs; with whom, nevertheless, they keep a secret intelligence, favouring their excursions and plunders.

CAPHTOR, (anc. geog.) a town or district of Higher Egypt: and hence the people called *Caphtorim* or *Caphtoraei.*—Caphtor is an island of Egypt, Ai Caphtor, (Jeremiah); probably one of those in the Nile. Dr Wells supposes it to be Coptos, which stood in a small island. Thence came the *Caphtorim* or *Caphtoraei,* in Palestine; who with the Philistines conspired to extirpate the Hevaei; and whose name was swallowed up in that of the Philistines.

CAPI-AGA, or *Capi-Agassi,* a Turkish officer who is governor of the gates of the seraglio, or grand master of the seraglio.

The capi-aga is the first dignity among the white eunuchs:

eunuchs: he is always near the person of the grand signior: he introduces ambassadors to their audience; nobody enters or goes out of the grand signior's apartment but by his means. His office gives him the privilege of wearing the turban in the seraglio, and of going every where on horseback. He accompanies the grand signior to the apartment of the sultanas, but stops at the door without entering. His appointment is very moderate; the grand signior bears the expence of his table, and allows him at the rate of about sixty French livres per day: but his office brings him in abundance of presents; no affair of consequence coming to the emperor's knowledge without passing through his hand. The capi-aga cannot be bashaw when he quits his post.

CAPIAS, in law, a writ of two sorts; one before judgment in an action, and the other after. That before judgment is called *capias ad respondendum*, where an original is issued out, to take the defendant, and make him answer the plaintiff. That after judgment is of divers kinds; as,

*Capias ad Satisfaciendum*, a writ of execution that issues on a judgment obtained, and lies where any person recovers in a personal action, as for debt, damages, &c. in which case this writ issues to the sheriff, commanding him to take the body of him against whom the debt is recovered, who is to be kept in prison till he make satisfaction.

*Capias pro Fine*, is a writ lying where a person is fined to the king, for some offence committed against a statute, and he does not discharge the fine according to the judgment: therefore his body shall be taken by this writ, and committed to gaol till the fine is paid.

*Capias Utlegatum*, a writ which lies against any one outlawed, upon any action personal or criminal, by which the sheriff is ordered to apprehend the party outlawed, for not appearing on the exigent, and keep him in safe custody till the day of return, when he is ordered to present him to the court, to be there farther ordered for his contempt.

*Capias in Withernam*, a writ that lies for cattle *in withernam*: that is, where a distress taken is driven out of the county, so that the sheriff cannot make deliverance upon a replevin; then this writ issues, commanding the sheriff to take as many beasts of the distrainer, &c.

CAPIGI, a porter or door-keeper of the Turkish seraglio. There are about five hundred *capigis* or porters in the seraglio, divided into two companies; one consisting of three hundred, under a chief called *Capigi-Bassa*, who has a stipend of three ducats per day; the other consists of two hundred, distinguished by the name of *Cuccicapigi*, and their chief *Cuccicapigi-Bassa*, who has two ducats. The capigis have from seven to fifteen aspers per day; some more, others less. Their business is to assist the janizaries in the guard of the first and second gates of the seraglio; sometimes all together, as when the Turk holds a general council, receives an ambassador, or goes to the mosque; and sometimes only in part; being ranged on either side to prevent people entering with arms, any tumults being made, &c. The word, in its original, signifies *gate*.

CAPILLAMENT, in a general sense, signifies a hair: whence the word is applied to several things, which on account of their length, or the fineness, resemble hairs: as,



*Capillaments of the Nerves*, in anatomy, the fine fibres or filaments whereof the nerves are composed.

CAPILLARY, in a general sense, an appellation given to things on account of their extreme fineness or resembling hairs

*Capillary Tubes*, in physics, are small pipes of glass, whose canals are extremely narrow, their diameter being only a half, a third, or a fourth of a line.

The ascent of water, &c. in capillary tubes, is a phenomenon that has long embarrassed the philosophers: for let one end of a glass tube open at both extremities be immerged in water, the liquor within the tube will rise to a considerable height above the external surface: or if two or more tubes are immerged in the same fluid, one a capillary tube, and the other of a larger bore, the fluid will ascend heigher in the former than in the latter; and this will be in a reciprocal ratio of the diameters of the tubes.

In order to account for this phenomenon, it will be necessary first to premise, that the attraction between the particles of glass and water is greater than the attraction between the particles of waters themselves: for if a glass tube be placed in a position parallel to the horizon, and a drop of water be applied to the under side of the tube, it will adhere to it; nor will it fall from the glass till its bulk and gravity are so far increased, as to overcome the attraction of the glass. Hence it is easy to conceive how sensibly such a power must act on the surface of a fluid, not viscid, as water, contained within the small cavity or bore of a glass-tube; as also that it will be proportionably stronger as the diameter of the bore is smaller; for it will be evident that the efficacy of the power is in the inverse proportion of the diameter, when it is considered, that such particles only as are in contact with the fluid, and those immediately above the surface, can effect it.

Now these particles form a periphery contiguous to the surface, the upper part of which attracts and raises the surface, while the lower part, which is in contact with it, supports it: so that neither the thickness nor length of the tube is of any consequence here; the periphery of particles only, which is always proportionable to the diameter of the bore, is the only acting power. The quantity of the fluid raised will therefore be as the surface of the bore which it fills, that is, as the diameter; for otherwise the effect would not be proportional to the cause, since the quantities are always as the ratio of the diameters; the heights therefore to which the fluids will rise, in different tubes, will be inversely as the diameters.

Some doubt whether the law holds throughout, of the ascent of the fluid being always higher as the tube is smaller: Dr Hook's experiments, with tubes almost as fine as cobwebs, seem to show the contrary. The water in these, he observes, did not rise so high as one would have expected. The highest he ever found it, was at 21 inches above the level of the water in the bason; which is much short of what it ought to have been by the law abovementioned. See Cohesion.

*Capillary Vessels*. Many small vessels of animal bodies have been discovered by the modern invention of injecting the vessels of animals with a coloured fluid which

which upon cooling grows hard. But though most anatomists know the manner of filling the large trunks, few are acquainted with the art of filling the capillaries. Dr Monro, in the Medical Essays, has given what after many trials he has found successful. See INJECTION.

CAPILLUS VENERIS. See ADIANTHUM.

CAPILUPI, or CAPILUPUS, (Camillus), a native of Mantua, in the 16th century. He wrote a book, entitled, *The Stratagem;* in which he relates not only what was perpetrated at Paris during the massacre on St Bartholomew's day, but also the artful preparations which preceded that horrid massacre. It is, however, blended with a great number of falsities.

CAPILUPI, (Lœlius) an Italian poet, brother to the former, made himself famous by his Centos of Virgil. The manner in which he applied Virgil's expressions to represent things which the poet never dreamt of, is admired. His Cento against women is very ingenious, but very satirical. The poems of Capilupi are inserted in the *Deliciæ Poetarum Italorum.*

CAPISCOLUS, or CAPISCHOLUS, in ecclesiastical writers, denotes a dignitary in certain cathedrals, who had the superintendency of the choir, or band of music, answering to what in other churches is called *chanter* or *precentor*. The word is also written *cabiscolus*, and *caputscholæ*, q. d. the head of the school, or band of music.

The capiscolus is also called *scolasticus*, as having the instruction of the young clerks and choristers, how to perform their duty.

CAPITA, (distribution by) in law, signifies the appointing to every one an equal share of a personal estate; when all the claimants claim in their own rights, as in equal degrees of kindred, and not *jure repræsentationis*.

CAPITA, (succession by), where the claimants are next in degree to the ancestor, in their own right, and not by right of representation.

CAPITAL, of the Latin *caput*, "the head," is used on various occasions, to express the relation of a head, chief, or principal: thus,

*CAPITAL City*, in geography, denotes the principal city of a kingdom, state, or province.

*CAPITAL Stock*, among merchants, bankers, and traders, signifies, the sum of money which individuals bring to make up the common stock of a partnership when it is first formed. It is also said of the stock which a merchant at first puts into trade for his account. It likewise signifies the fund of a trading company or corporation, in which sense the word stock is generally added to it. Thus we say, the capital stock of the bank, &c. The word capital is opposed to that of profit or gain, though the profit often increases the capital, and becomes of itself part of the capital, when joined with the former.

*CAPITAL Crime*, such a one as subjects the criminal to capital punishment, that is, to loss of life*.

* See *Crime* and *Punishment*.

*CAPITAL Picture*, in painting, denotes one of the finest and most excellent pieces of any celebrated master.

*CAPITAL Letters*, in printing, large or initial letters, wherein titles, &c. are composed; with which all periods, verses, &c. commence; and wherewith also all proper names of men, kingdoms, nations, &c. begin. The practice which, for some time, obtained among our printers, of beginning every substantive with a capital, is now justly fallen into disrepute; being a manifest perversion of the design of capitals, as well as an offence against beauty and distinctness.



CAPITAL, in architecture, the uppermost part of a column or pilaster, serving as the head or crowning, and placed immediately over the shaft, and under the entablature. See ARCHITECTURE.

CAPITANA, or CAPTAIN *Galley*, the chief or principal galley of a state, not dignified with the title of a kingdom. The capitana was anciently the denomination of the chief galley of France, which the commander went on board of. But since the suppression of the office of captain-general of the gallies in 1669, they have no capitana, but the first galley is called *reale*, and the second *parone*.

CAPITANATA, one of the 12 provinces of the kingdom of Naples, in Italy, bounded on the north by the Gulph of Venice, on the east by the Terra di Barri, on the south by the Basilicata and the Farther Principato, and on the west by the county di Molise and a small part of Hither Abruzzo. It is a level country, without trees; the soil sandy, the air hot; the land, however, near the rivers is fertile in pastures. The capital town is Manfredonia.

CAPITANEATE, in a general sense, the same with capitania. Capitaneates, in Prussia, are a kind of noble-feuds, or estates, which, besides their revenue, raise their owners to the rank of nobility. They are otherwise called *starosties*.

CAPITANEI, or CATANEI, in Italy, was a denomination given to the dukes, marquisses, and counts, who were called *capitanei regis*. The same appellation was also given to persons of inferior rank who were invested with fees, formerly distinguished by the appellation *valvasores majores*.

CAPITANEUS, in ancient law writers, denotes a tenant in capite, or chief.

*CAPITANEUS Ecclesiæ*, the same with advocate.

CAPITANIA, in geography, an appellation given to the 12 governments established by the Portuguese in the Brasils.

CAPITATION, a tax or imposition raised on each person, in proportion to his labour, industry, office, rank, &c. It is a very ancient kind of tribute. The Latins call it *tributum*, by which taxes on persons are distinguished from taxes on merchandise, which were called *vectigalia*.

Capitations are seldom practised but in great exigencies of state. In France the capitation was introduced by Louis XIV. in 1695; and is a tax very different from the *taille*, being levied from all persons, whether they be subject to the taille or not. The clergy pay no capitation, but the princes of the blood are not exempted from it.

CAPITE, in law, (from *caput*, i. e. *rex*; whence *tenere in capite*, is to hold of the *king*, the *head* or lord paramount of all the lands in the kingdom): an ancient tenure of land, held immediately of the king, as of his crown, either by knight's service, or by soccage. It is now abolished. See TENURE.

CAPITE *Censi*, in antiquity, the lowest rank of Roman citizens, who in public taxes were rated the least of all, being such as never were worth above 365 asses. They were supposed to have been thus called, because they were rather counted and marshalled by their heads than by their estates. The *capite censi* made part of the sixth class of citizens, being below the *proletarii*, who formed the other moiety of that class. They were not enrolled in the army, as being judged not able to support the expence of war; for in those days the soldiers maintained themselves. It does not appear, that before Caius Marius any of the Roman generals listed the *capite censi* in their armies.

CAPITOL, Capitolium, in antiquity, a famous fort or castle, on the Mons Capitolinus at Rome, wherein was a temple dedicated to Jupiter, thence also denominated *Capitolinus*, in which the senate anciently assembled; and which still serves as the city-hall, or town-house, for the meeting of the conservators of the Roman people.—It had its name *capitol*, from *caput*, a man's head, said to have been found fresh, and yet bleeding, upon digging the foundation of the temple built in honour of Jupiter. Arnobius adds, that the man's name was *Tolus*, whence *caput-tolium*.—The first foundations of the capitol were laid by Tarquin the Elder, in the year of Rome 139. His successor Servius raised the walls; and Tarquin the Proud finished it in the year 221. But it was not consecrated till the third year after the expulsion of the kings, and establishment of the consulate. The ceremony of the dedication of the temple was performed by the consul Horatius in 246.

The capitol consisted of three parts; a nave sacred to Jupiter; and two wings, the one consecrated to Juno, the other to Minerva: it was ascended to by stairs; the frontispiece and sides were surrounded with galleries, in which those who were honoured with triumphs entertained the senate at a magnificent banquet, after the sacrifices had been offered to the gods.

Both the inside and outside were inriched with an infinity of ornaments, the most distinguished of which was the statue of Jupiter, with his golden thunderbolt, his sceptre, and crown. In the capitol also were a temple to Jupiter the guardian, and another to Juno, with the mint; and on the descent of the hill was the temple of Concord. This beautiful edifice contained the most sacred deposits of religion, such as the ancylia, the books of the Sibyls, *&c.*

The capitol was burnt under Vitellius, and rebuilt under Vespasian. It was burnt a second time by lightning under Titus, and restored by Domitian.

Anciently the name *capitol* was likewise applied to all the principal temples, in most of the colonies throughout the Roman empire; as at Constantinople, Jerusalem, Carthage, Ravenna, Capua, *&c.*—That of Thoulouse, has given the name of *capitouls* to its echevins or sheriffs.

CAPITOLINE games, annual games instituted by Camillus, in honour of Jupiter Capitolinus, and in commemoration of the capitol's not being taken by the Gauls. Plutarch tells us, that a part of the ceremony consisted in the public criers putting up the Hetrurians to sale by auction: they also took an old man, and tying a golden bulla about his neck, exposed him to the public derision. Festus says they also dressed him in a pretexta—There was another kind of Capitoline games instituted by Domitian, wherein there were rewards and crowns bestowed on the poets, champions, orators, historians, and musicians. These last Capitoline games were celebrated every five years, and became so famous, that instead of calculating time by lustra, they began to count by Capitoline games, as the Greeks did by Olympiads. It appears, however, that this custom was not of long continuance.



CAPITOLINUS, (Julius) an historian in the beginning of the fourth age under Dioclesian, to whom he inscribed the Lives of Verus, Antoninus Pius, Clodius Balbinus, Macrinus, the Maximins, and the Gordians. He wrote other lives, which are most of them lost.

CAPITOUL, or Capitol, an appellation given to the chief magistrates of Thoulouse, who have the administration of justice and policy both civil and mercantile in the city. The capitouls at Thoulouse are much the same with the echevins at Paris, and with the consuls, bailiffs, burger-masters, mayors, and aldermen, &c. in other cities. In the ancient acts they are called *consules capitularii* or *capitolini*, and their body *capitulum*. From this last come the words *capitularii* and *capitouls*. The appellative *capitolini* arose hence, that they have the charge and custody of the town-house which was anciently called *capitol*.

The office only lasts one year, and ennobles the bearers. In some ancient acts they are called *capitulum nobilium Tolosæ*. Those who have borne it, style themselves afterwards burgesses. They are called to all general councils, and have the *jus imaginum;* that is, when the year of their administration is expired, their pictures are drawn in the town-house: a custom which they have retained from the ancient Romans, as may be seen in Sigonius.

CAPITOULATE, an appellation given to the several quarters or districts of the city of Thoulouse, each under the direction of a capitoul; much like the wards of London, under their aldermen. Thoulouse is now divided into eight *capitoulates* or quarters, which are subdivided into *moulans*, each of which has its tithing-man, whose business is to inform the capitoul of what passes in his tithing, and to inform the inhabitants of the tithing of the orders of the capitoul.

CAPITULAR, or capitulary, denotes an act passed in a chapter, either of knights, canons, or religious.

The capitularia, or capitulars of Charlemagne, Charles the Bald, &c. are the laws, both ecclesiastical and civil, made by those emperors in the general councils or assemblies of the people; which was the way in which the constitutions of most of the ancient princes were made; each person present, though a plebeian, setting his hand to them.

Some distinguish these from laws; and say, they were only supplements to laws. They had their name, capitulars, because divided into capitula, chapters, or sections. In these capitulars did the whole French jurisprudence anciently consist. In process of time, the name was changed for that of ordonnances.

Some distinguish three kinds of capitulars, according to the difference of their subject-matter: those on ecclesiastical affairs, are really canons, extracted from councils; those on secular affairs, real laws; those relating to particular persons, or occasions, private regulations.

CAPITULATION, in military affairs, a treaty made between the inhabitants or garrison of a place besieged

besieged and the besiegers, for the delivering up the place on certain conditions. The most honourable and ordinary terms of capitulation are, To march out at the breach with arms and baggage, drums beating, colours flying, a match lighted at both ends, and some pieces of cannon, waggons and convoys for their baggage, and for their sick and wounded.

Capitulation, in the German polity, a contract which the emperor makes with the electors, in the name of all the princes and states in the empire, before he is declared emperor, and which he ratifies before he is raised to that sovereign dignity. The principal points which the emperor undertakes to observe are, 1. To defend the church and empire. 2. To observe the fundamental laws of the empire. And, 3. To maintain and preserve the rights, privileges, and immunities of the electors, princes, and other states of the empire, specified in the capitulation. These articles and capitulations are presented to the emperor by the electors only, without the concurrence of the other states who have complained from time to time of such proceedings; and in the time of the Westphalian treaty, in 1648, it was proposed to deliberate in the following diet, upon a way of making a perpetual capitulation; but the electors have always found means of eluding the execution of this article. In order, however, to give some satisfaction to their adversaries, they have inserted in the capitulations of the emperors, and in that of Francis I. in particular, a promise to use all their influence to bring the affair of a perpetual capitulation to a conclusion. Some German authors own, that this capitulation limits the emperor's power; but maintain that it does not weaken his sovereignty: though the most part maintain that he is not absolute, because he receives the empire under conditions, which sets bounds to an absolute authority.

CAPITULUM, in the ancient military art, was a transverse beam, wherein were holes through which passed the strings whereby the arms of huge engines, as balistæ, catapultæ, and scorpions, were played or worked.

Capitulum, in ecclesiastical writers, denoted part of a chapter of the Bible read and explained. In which sense they said, *ire ad capitulum,* to go to such a lecture. Afterwards the place or apartment where such theological exercises were performed was denominated *domus capituli.*

CAPNICON, in antiquity, chimney-money, or a tax which the Roman emperors levied for smoke, and which of consequence was due from all, even the poorest, who kept a fire. This was first invented by Nicephorus.

CAPNOMANCY, a kind of divination by means of smoke, used by the ancients in their sacrifices. The word comes from καπνος, *smoke,* and μαντεια, *divination.* The general rule was, when the smoke was thin, and light, and rose straight up, it was a good omen: if the contrary, it was an ill one. There was also another species of capnomancy, consisting in the observation of the smoke rising from poppy and jessamin-seed, cast upon lighted coals.

CAPO fino, a large barren rock in the territory of the Genoese, which has a castle on its eastern peak. Near it is a small harbour of the same name, 13 miles east by south of Genoa.



*Capo d'Istria,* a considerable town of Italy, in Istria, on the gulph of Trieste, with a bishop's see, and subject to the Venetians. The air is wholesome and temperate; its principal revenue consists in wine and salt. E. Long. 14. 0. N. Lat. 45. 48.

CAPON, a cock-chicken, gelded as soon as left by the dam, or as soon as he begins to crow. They are of use either to lead chickens, ducklings, pheasants, &c. and defend them from the kites and buzzards; or to feed for the table, they being reckoned more delicate than either a cock or a hen.

CAPONIERE, or Capponiere, in fortification, a covered lodgement, sunk four or five feet into the ground, encompassed with a little parapet about two feet high, serving to support several planks covered with earth. The caponiere is large enough to contain 15 or 20 soldiers; and is usually placed in the glacis on the extremity of the counterscarp, and in dry moats; having little embrasures for the soldiers to fire through.

CAPPADOCIA, an ancient kingdom of Asia, comprehending all that country which lies between mount Taurus and the Euxine sea. It was divided by the Persians into two satrapies or governments; by the Macedonians into two kingdoms, the one called *Cappadocia ad Taurum;* the other, *Cappadocia ad Pontum,* and commonly *Pontus;* for the history, &c. of which last, see the article Pontus.

*Cappadocia Magna,* or *Cappadocia* properly so called, lies between the 38th and 41st degrees of north latitude. It was bounded by Pontus on the north, Lycaonia and part of Armenia Major on the south, Galatia on the west, and by Euphrates and part of Armenia Minor on the east. The first king of Cappadocia we read of in history was Pharnaces, who was preferred to the crown by Cyrus king of Persia, who gave him his sister Atossa in marriage. This is all we find recorded of him, except that he was killed in a war with the Hyrcanians. After him came a succession of eight kings, of whom we know scarce any thing but that they continued faithful to the Persian interest. In the time of Alexander the Great, Cappadocia was governed by Ariarathes II. who, notwithstanding the vast conquests and fame of the Macedonian monarch, continued unshaken in his fidelity to the Persians. Alexander was prevented by death from invading his dominions; but Perdiccas marching against him with a powerful and well disciplined army, dispersed his forces, and having taken Ariarathes himself prisoner, crucified him, with all those of the royal blood whom he could get into his power. Diodorus tells us that he was killed in the battle. He is said to have reigned 82 years. His son Ariarathes III. having escaped the general slaughter of the royal family, fled into Armenia, where he lay concealed, till the civil dissensions which arose among the Macedonians gave him a fair opportunity of recovering his paternal kingdom. Amyntas, at that time the governor of Cappadocia, opposed him: but being defeated in a pitched battle, the Macedonians were obliged to abandon all the strong holds. Ariarathes, after a long and peaceable reign, left his kingdom to his son Ariaramnes II. He applied himself more to the arts of peace than war, in consequence of which Cappadocia flourished greatly during his reign. He was succeeded by his son Ariarathes IV. who

Cappadocia. who proved a very warlike prince, and having overcome Arsaces, founder of the Parthian monarchy, considerably enlarged his own dominions.

He was succeed by Ariarathes V. who marrying the daughter of Antiochus the Great, entered into an alliance with that prince against the Romans; but Antiochus being defeated, the king of Cappadocia was obliged to sue for peace. which he obtained, after having paid 200 talents by way of fine, for taking up arms against the people of Rome. He afterwards assisted the republic with men and money against Perseus king of Macedon, on which account he was by the senate honoured with the title of the *friend and ally of the Roman people*. He left the kingdom in a very flourishing condition to his son Mithridates, who on his accession took the name of Ariarathes VI.

This prince (surnamed *Philopater*, from the filial respect and love he showed his father from his very infancy) immediately renewed the alliance with Rome. Out of mere good-nature he restored Mithrobuzanes son to Ladriades king of Lesser Armenia to his father's kingdom, though he foresaw that the Armenians would lay hold of that opportunity to join Artaxias, who was then on the point of invading Cappadocia. These differences, however, were settled before they came to an open rupture, by the Roman legates; and Ariarathes seeing himself thus delivered from an impending war by the mediation of the republic, presented the senate with a golden crown, and offered his service wherever they thought proper to employ him. The senate in return sent him a staff, and chair of ivory; which were presents usually bestowed on those only whom they looked upon as attached to their interest. Not long before this, Demetrius Soter king of Syria had offered Ariarathes his sister in marriage, the widow of Perseus king of Macedon: but this offer the king of Cappadocia was obliged to decline for fear of offending the Romans; and his so doing was in the highest degree acceptable to the republic, who reckoned him among the chief of her allies. Demetrius, however, being greatly incensed at the slight put upon his sister, set up a pretender to the throne, one Orophernes, a suppositititious, or, as others call him, a natural son of the deceased king. The Romans ordered Eumenes king of Pergamus to assist Ariarathes with all his forces: which he did, but to no purpose: for the confederates were overthrown by Demetrius, and Ariarathes was obliged to abandon the kingdom to his rival. This happened about 159 years before Christ, and the usurper immediately dispatched ambassadors to Rome with a golden crown. The senate declined accepting the present, till they heard his pretensions to the kingdom; and this Orophernes, by suborned witnesses, made appear so plain, that the senate decreed that Ariarathes and he should reign as partners; but next year, Orophernes was driven out by Attalus brother to Eumenes, and his successor to the kingdom of Pergamus.

Ariarathes, being thus restored, immediately demanded of the Priennians 400 talents of gold which Orophernes had deposited with them. They honestly replied, that as they had been trusted with the money by Orophernes, they could deliver it to none but himself, or such as came in his name. Upon this, the king entered their territories with an army, destroying all with fire and sword. The Priennians, however, still persevered in their integrity; and though the city was besieged by the united forces of Ariarathes and Attalus, not only made an obstinate defence, but found means to restore the sum to Orophernes. At last they applied to the Romans for assistance, who enjoined the two kings to raise the siege, under pain of being declared enemies to the republic. Ariarathes immediately obeyed; and marching his army into Assyria, joined Alexander Epiphanes against Demetrius Soter, by whom he had been formerly driven out of his kingdom. In the very first engagement Demetrius was slain, and his army entirely dispersed, Ariarathes having on that occasion given uncommon proofs of his courage and conduct. Some years after, war breaking out between the Romans and Aristonicus, who claimed the kingdom of Pergamus in right of his father, Ariarathes joined the former, and was slain in the same battle in which P. Crassus proconsul of Asia was taken, and the Roman army cut in pieces. He left six sons by his wife Laodice, on whom the Romans bestowed Lycaonia and Cilicia. But Laodice, fearing lest her children when they came of age, should take the government out of her hands, poisoned five of them, the youngest only having escaped her cruelty by being conveyed out of the kingdom. The queen herself was soon after put to death by her subjects, who could not bear her cruel and tyrannical government.

Laodice was succeeded by Ariarathes VII. who, soon after his accession, married another Laodice, daughter of Mithridates the great, hoping to find in that prince a powerful friend to support him against Nicomedes king of Bithynia, who laid claim to part of Cappadocia. But Mithridates instead of assisting, procured one Gordius to poison his unhappy son-in-law; and, on his death, seized the kingdom, under pretence of maintaining the rights of the Cappadocians against Nicomedes, till the children of Ariarathes were in a condition to govern the kingdom. The Cappadocians at first fancied themselves obliged to their new protector; but, finding him unwilling to resign the kingdom to the lawful heir, they rose up in arms, and, driving out all the garrisons placed by Mithridates, placed on the throne Ariarathes VIII. eldest son of their deceased king.

The new prince found himself immediately engaged in a war with Nicomedes; but, being assisted by Mithridates, not only drove him out of Cappadocia, but stripped him of a great part of his hereditary dominions. On the conclusion of the peace, Mithridates, seeking for some pretence to quarrel with Ariarathes, insisted upon his recalling Gordius, who had murdered his father; which being rejected with abhorrence, a war ensued. Mithridates took the field first, in hopes of over-running Cappadocia before Ariarathes could be in a condition to make head against them; but, contrary to his expectation, he was met on the frontiers by the king of Cappadocia with an army no way inferior to his own. Hereupon he invited Ariarathes to a conference; and, in sight of both armies, stabbed him with a dagger, which he had concealed under his garment. This struck such terror into the Cappadocians, that they immediately dispersed, and gave Mithridates an opportunity of possessing himself of the kingdom without the least opposition. The Cappadocians, however, not able to endure the tyranny of his prefects, soon

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shook off the yoke; and recalling the king's brother, who had fled into the province of Asia, proclaimed him king. He was scarce seated on the throne, however, before Mithridates invaded the kingdom at the head of a very numerous army, and having drawn Ariarathes to a battle, defeated his army with great slaughter, and obliged him to abandon the kingdom. The unhappy prince soon after died of grief; and Mithridates bestowed the kingdom on his son, who was then but eight years old, giving him also the name of *Ariarathes*. But Nicomedes Philopater king of Bythynia, fearing lest Mithridates, having now got possession of the whole kingdom of Cappadocia, should invade his territories, suborned a youth to pass himself for the third son of Ariarathes, and to present to them a petition in order to be restored to his father's kingdom. With him he sent to Rome Laodice, sister of Mithridates, whom he had married after the death of her former husband Ariarathes. Laodice declared before the senate that she had three sons by Ariarathes, and that the petitioner was one of them; but that she had been obliged to keep him concealed, lest he should undergo the same fate with his brothers. The senate assured him that they would at all events reinstate him in his kingdom. But, in the mean time, Mithridates having notice of these transactions, dispatched Gordius to Rome, to undeceive the senate, and to persuade them that the youth to whom he had resigned the kingdom of Cappadocia was the lawful son of the late king, and grandson to Ariarathes who had lost his life in the service of the Romans against Aristonicus. This unexpected embassy put the senate upon enquiring more narrowly into the matter, whereby the whole plot was discovered; upon which Mithridates was ordered to resign Cappadocia, and the kingdom was declared free. The Cappadocians, however, in a short time sent ambassadors to Rome, acquainting the senate that they could not live without a king. This greatly surprised the Romans, who had such an aversion to royal authority; but they gave them leave to elect a king of their own nation. As the family of Pharnaces was now extinct, the Cappadocians chose Ariobarzanes; and their choice was approved by the senate, he having on all occasions shewn himself a steady friend to the Romans.

Ariobarzanes had scarce taken possession of his kingdom when he was driven out by Tigranes king of Armenia; who resigned Cappadocia to the son of Mithridates, in pursuance of an alliance previously concluded between the two parties. Ariobarzanes fled to Rome; and, having engaged the senate in his cause, he returned into Asia with Sylla, who was enjoined to restore him to his kingdom. This was easily performed by Sylla, who, with a small body of troops, routed Gordius who came to meet him on the borders of Cappadocia at the head of a numerous army. Sylla, however, had scarce turned his back, when Ariobarzanes was again driven out by Ariarathes the son of Mithridates, on whom Tigranes had bestowed the kingdom of Cappadocia. This obliged Sylla to return into Asia, where he was attended with his usual success, and Ariobarzanes was again placed on the throne. After the death of Sylla, he was the third time forced by Mithridates to abandon his kingdom; but Pompey, having entirely defeated Mithridates near mount Stella, restored Ariobarzanes to his throne, and rewarded him for his services during the war, with the provinces of Sophene, Gordiene, and great part of Cilicia. The king, however, being now advanced in years, and desirous of spending the remainder of his life in ease, resigned the crown to his son Ariobarzanes, in presence of Pompey; and never afterwards troubled himself with affairs of state.

Ariobarzanes II. proved no less faithful to the Romans than his father had been. On the breaking out of the civil war between Cæsar and Pompey, he sided with the latter; but after the death of Pompey, he was received into favour by Cæsar, who even bestowed upon him great part of Armenia. While Cæsar was engaged in a war with the Egyptians, Pharnaces king of Pontus invaded Cappadocia, and stripped Ariobarzanes of all his dominions; but Cæsar having defeated Pharnaces, restored the king of Cappadocia, and honoured him with new titles of friendship. After the murder of Cæsar, Ariobarzanes, having refused to join Brutus and Cassius, was by them declared an enemy to the republic, and soon after taken prisoner and put to death. He was succeeded by his brother Ariobarzanes III. who was by Marc Anthony deprived both of his kingdom and life; and in him ended the family of Ariobarzanes.

Archelaus, the grandson of that general of the same name who commanded against Sylla in the Mithridatic war, was by Marc Anthony placed on the throne of Cappadocia, though nowise related either to the family of Pharnaces or Ariobarzanes. His preferment was entirely owing to his mother Glaphyra, a woman of great beauty, but of loose behaviour, who, in return for her compliance with the desires of Anthony, obtained the kingdom of Cappadocia for her son. In the war between Augustus and Anthony, he joined the latter; but at the intercession of the Cappadocians, was pardoned by the emperor. He afterwards received from him Armenia the Lesser, and Cilicia Trachæa, for having assisted the Romans in clearing the seas of pirates who greatly infested the coasts of Asia. He contracted a strict friendship with Herod the Great, king of Judæ; and even married his daughter Glaphyra to Alexander, Herod's son. In the reign of Tiberius, Archelaus was summoned to appear before the senate; for he had always been hated by that emperor, because in his retiremet at Rhodes he had paid him no sort of respect. This had proceeded from no aversion in him to Tiberius, but from the warning given Archelaus by his friends at Rome. For Caius Cæsar, the presumptive heir to the empire, was then alive, and had been sent to compose the differences of the east, whence the friendship of Tiberius was then looked upon as dangerous. But when he came to the empire, Tiberius, remembering the disrespect shown him by Archelaus, enticed the latter to Rome by means of letters from Livia, who promised him her son Tiberius's pardon, provided he came in person to implore it. Archelaus obeyed the summons, and, hastened to Rome; where he was received by the emperor with great wrath and contempt, and soon after accused as a criminal in the senate. The crimes of which he was accused were mere fictions; but his concern at seeing himself treated as a malefactor was so great, that he died soon after of grief, or, as others say, laid violent

lent hands on himself. He is said to have reigned 50 years.

On the death of Archelaus, the kingdom of Cappadocia was reduced to a Roman province, and governed by those of the equestrian order. It continued subject to the Romans till the invasion of the eastern empire by the Turks, to whom it is now subject, but has no distinguishing modern name. In what was anciently called *Cappadocia*, however, the Turks have four Beglerbeglics, called *Siwas*, *Trebizond*, *Marasch*, and *Cogni*.

In the time of the Romans, the inhabitants of Cappadocia bore so bad a character, and were reputed so vicious and lewd, that, among the neighbouring nations, a wicked man was emphatically called a *Cappadocian*. In after ages, however, their lewd disposition was so corrected and restrained by the pure doctrines of Christianity, that no country whatever has produced greater champions of the Christian religion, or given to the church prelates of more unblemished characters.

We have now no system of the Cappadocian laws, and scarce wherewithal to form any particular idea of them. As to their commerce, they carried on a considerable trade in horses, great numbers of which were produced in their country; and we read of them in Scripture as frequenting the fairs of Tyre with this commodity. As Cappadocia abounded with mines of silver, brass, iron, and allum, and afforded great store of alabaster, crystal, and jasper, it is probable that they might supply the neighbouring countries with these commodities.

The religion of the ancient Cappadocians was much the same with that of the Persians. At Comana there was a rich and stately temple dedicated to Bellona; whose battles the priests and their attendants used to represent on stated days, cutting and wounding each other as if seized with an enthusiastic fury. No less famous and magnificent were the temples of Apollo Catanius, and of Jupiter: the last of which had 3000 sacred servants, or religious votaries. The chief priest was next in rank to that of Comana; and, according to Strabo, had an yearly revenue of 15 talents. Diana Persica was worshipped in a city called *Castaballa*, where women devoted to the worship of that goddess, were reported to tread barefooted on burning coals, without receving any hurt. The temples of Diana at Diospolis, and of Anias at Zela, were likewise held in great veneration both by the Cappadocians and Armenians who flocked to them from all parts. In the latter were tendered all oaths in matters of consequence; and the chief among the priests was no way inferior in dignity, power, and wealth, to any in the kingdom; having a royal attendance, and an unlimited authority over all the inferior servants and officers of the temple. The Romans, who willingly adopted all the superstitions and superstitious rites of the nations they conquered, greatly increased the revenues of this and other temples; conferring the priesthood on such as they thought most fit for carrying on their designs.—We are told that human sacrifices were offered at Comana; and that this barbarous custom was brought by Orestes and his sister Iphigenia from Taurica Scythica, where men and women were immolated to Diana. But this custom, if ever it obtained at Cappadocia, was abolished in the times of the Romans.



CAPPANUS, a name given by some authors to a worm that adheres to and gnaws the bottoms of ships; to which it is extremely pernicious, especially in the East and West-Indies: to prevent this several ships have been lately sheathed with copper; the first trial of which was made on a British frigate the Alarm.

CAPPARIS, in botany: A genus of the monogynia order, belonging to the polyandria class of plants; and in the natural method ranking under the 25th order, *Putamineæ*. The calyx is tetraphyllous and coriaceous; their petals are four; the stamina are long; the fruit is a berry, carnous, unilocular and pedunculated, or furnished with a foot-stalk.

There are seven species. The spinosa, or common caper, is a low shrub, generally growing out of the joints of old walls, the fissures of rocks, and amongst rubbish, in most of the warm parts of Europe: it hath woody stalks, which send out many lateral slender branches, under each of these are placed two short crooked spines, between which and the branches come out the footstalks of the leaves, which are single, short, and sustain a round smooth entire leaf. At the intermediate joints, between the branches, come out the flowers on long foot-stalks; before these expand, the bud with the impalement is gathered for pickling. Those which are last expand in form of a single rose, having five large white petals, which are roundish and concave; in the middle are placed a great number of long stamina, surrounding a style which rises above them, and crowned with an oval germen, which afterwards becomes a capsule filled with kidney-shaped seeds.

*Culture.* This plant is very difficultly preserved in Britain: it delights to grow in crevices of rocks, old walls, &c. and always thrives best in an horizontal posture; so that, when planted either in pots or in the full ground, they seldom thrive, though they may be kept alive for some years. They are propagated by seeds in the warm parts of Europe, but very seldom in Britain.

*Uses.* The buds, pickled with vinegar, &c. are brought to Britain annually from Italy and the Mediterranean. They are supposed to excite appetite and assist digestion; and to be particularly useful as detergents and aperients in obstructions of the liver and spleen.

CAPRA, or GOAT, a genus of quadrupeds belonging to the order of pecora. The horns are hollow, turned upwards, erect, and scabrous. There are eight fore-teeth in the under jaw, and none in the upper; and they have no dog-teeth. This genus consists of 14 species, viz. Plates CXXI. CXXII. CXXIII. CXXIV.

I. The HIRCUS, or common goat, with arched carinated horns, and a long beard. It is a native of the eastern mountains.

The goat is an animal of more sagacity than the sheep. Instead of having an antipathy at mankind, they voluntarily mingle with them, and are easily tamed. Even in uninhabited countries, they betray no savage dispositions. In the year 1698, an English vessel having put in to the island of Bonavista, two negroes came aboard, and offered gratis to the captain as

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Goats are sensible of caresses and capable of a considerable degree of friendship. They are stronger, more agile, and less timid, than sheep. They have a lively, capricious, and wandering disposition; are fond of high and solitary places, and frequently sleep upon the very points of rocks. They are more easily supported than any other animal of the same size; for there is hardly an herb, or the bark of a tree, which they will not eat with pleasure. Neither are they liable to so many diseases as sheep: they can bear heat and cold with less inconvenience. The actions and movements of animals depend more upon the force and variety of their sensations than the structure of their bodies: the natural inconstancy or fancifulness of goats is accordingly expressed by the irregularity of their actions; they walk, stop short, run, jump, show, and hide themselves, as it were by mere caprice, and without any other cause than what arises from the natural vivacity of their temper.

The buck will copulate when he is a year old, and the female when she is seven months. But as this is rather premature, they are generally restrained till they be 18 months or two years. The buck is bald, beautiful, and vigorous; one is sufficient to serve 150 females. A buck for propagation should be large, handsome, and about two years of age; his neck should be short and fleshy; his head slender; his ears pendent: his thighs thick; his limbs firm; his hair black, thick, and soft; and his beard should be long and bushy. The females are generally in season from September to the end of November. At that time the males drive whole flocks of the females continually from place to place, and fill the whole atmosphere around them with their strong disagreeable odour; which, though as disagreeable as asafætida itself, yet may be conducive to prevent many distempers, and to cure nervous and hysterical ones. Horses are supposed to be much refreshed by it; on which account many people keep a he-goat in their studs or stables.

Goats go with young four months and an half, and bring forth from the latter end of February to the latter end of April: having only two teats, they generally bring forth but one or two young; sometimes three; and in good warm pastures there have been instances, tho' rare, of their bringing forth four at a time. They continue fruitful till they are seven years of age; but a buck goat is seldom kept after he is five. Both young and old are affected by the weather; a rainy season makes them thin, a dry sunny one makes them fat and blithe: their excessive venery prevents their longevity; for in our climate they seldom live above 11 or 12 years.

Though the food of this animal costs next to nothing, as it can support itself even upon the most barren mountains, their produce is valuable. In Britain the whitest wigs are made of their hair; for which purpose that of the he-goat is most in request; the whitest and clearest is selected from that which grows on the haunches, where it is longest and thickest: a good skin well haired is sold for a guinea; though a skin of bad hue, and so yellow as to baffle the barber's skill to bleach, will not fetch above 18 d. or 2 s. The Welsh goats are far superior in size, and in length and fineness of hair, to those of other mountainous countries. Their usual colour is white: those of France and the Alps are short-haired, reddish, and the horns small. Bolsters made from the hair of a goat were in use in the days of Saul, as appears from 1 Samuel xix. 13. The species very probably was the Angora goat, which is only found in the East; and whose soft and silky hair supplied a most luxuriant couch.

The suet of the goat is in great esteem as well as the hair. Many of the inhabitants of Caernarvonshire suffer these animals to run wild on the rocks in winter as well as in summer; and kill them in October for the sake of their fat, either by shooting them with bullets, or by running them down with dogs like deer. The goats killed for this purpose are about four or five years old. Their suet will make candles far superior in whiteness and goodness to those made from that of the sheep or the ox, and accordingly brings a much greater price in the market; nor are the horns without their use, the country people making of them excellent handles for tucks and pen-knives. The skin is peculiarly well adapted for the glove manufactory, especially that of the kid: abroad it is dressed and made into stockings, bedticks, bed-hangings, sheets, and even shirts. In the army it covers the horsemen's arms, and carries the foot-soldier's provisions. As it takes a dye better than any other skin, it was formerly much used for hangings in the houses of people of fortune, being susceptible of the richest colours, and when flowered and ornamented with gold and silver became an elegant and superb furniture.

The flesh is of great use to the inhabitants of those countries which abound with goats; and affords them a cheap and plentiful provision in the winter-months, when the kids are brought to market. The haunches of the goat are frequently salted and dried, and supply all the uses of bacon: this by the Welch is called *coch yr wden*, or hung venison. The meat of a splayed goat of six or seven years old (which is called *hyfr*) is reckoned the best; being generally very fat and sweet. This makes an excellent pasty; goes under the name of *rock venison*; and is little inferior to that of the deer.

The milk of the goat is sweet, nourishing, and medicinal. It is an excellent succedaneum for ass's milk; and has (with a tea-spoonful of hartshorn drunk warm in bed in the morning, and at four in the afternoon, and repeated for some time) been a cure for phthisical people before they were gone too far. In some of the mountainous parts of Scotland and Ireland, the milk is made into whey, which has done wonders in this and other cases where coolers and restoratives are necessary; and to many of those places there is as great a resort of patients of all ranks, as there is in England to the Spas or baths. It is not suprising that the milk of this animal is so salutary, as it browses only on the tops, tendrils, and flowers, of the mountain shrubs, and medicinal herbs; rejecting the grosser parts. The blood of

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of the he-goat, dried, was formerly reckoned a ſpecific in pleuriſies, and is even taken notice of by Dr Mead for this purpoſe; but is now deſervedly neglected. Cheeſe made of goats milk is much valued in ſome mountainous countries, when kept to a proper age; but has a peculiar taſte and flavour.

a. The Angora goat is a variety that is found only in the tract that ſurrounds Angora and Beibazar, towns in Aſiatic Turkey, for the diſtance of three or four days journey. Strabo ſeems to have been acquainted with this kind; for ſpeaking of the river Halys, he ſays, that there are goats found near it that are not known in other parts. In the form of their body they differ from the common goat, being ſhorter; their legs too are ſhorter, their ſides broader and flatter, and their horns ſtraighter; but the moſt valuable characteriſtic is their hair, which is ſoft as ſilk, of a gloſſy ſilvery whiteneſs, and curled in locks of eight or nine inches in length. This hair is the baſis the fine Britiſh camblets, and imported to England in form of thread; for the Turks will not permit it to be exported raw, for a reaſon that does them honour; becauſe it ſupports a multitude of poor, who live by ſpinning it. The goat-herds of Angora and Beibazar are extremely careful of their flocks, frequently combing and waſhing them. It is obſerved, that if they change their climate and paſture, they loſe their beauty: we therefore ſuſpect that the deſign of Baron Alſtroemer, a patriotic Swede, turned out fruitleſs, who imported ſome into his own country, to propagate the breed for the ſake of their hair.

b. The *Capricorn* of Buffon is another variety, having ſhort horns, the ends turned forwards, their ſides annulated, and the rings more prominent before than behind.

II. The IBEX, or wild-goat, is the ſtock from whence the tame ſpecies ſprung. It has large knotty horns reclined upon its back, is of a yellowiſh colour, and its beard is black. The females are leſs, and have ſmaller horns, more like thoſe of a common ſhe-goat, and with few knobs on the upper ſurface: they bring one young one, ſeldom two, at a birth. They inhabit the higheſt Alps of the Griſſon's country and the Valais; are alſo found in Crete. They are very wild, and difficult to be ſhot, as they always keep on the higheſt points. Their chaſe is exceedingly dangerous: being very ſtrong, they often tumble the incautious huntſmen down the precipices, except he has time to lie down, and let the animals paſs over him. They are ſaid not to be long-lived.

III. The MAMBRINA, or Syrian goat, with reclined horns, pendant ears, and a beard. It is a native of the Eaſt. Their ears are of a vaſt length; from one to two feet; and ſometimes ſo troubleſome, that the owners cut off one to enable the animal to feed with more eaſe. Theſe animals ſupply Aleppo with milk.

IV. The RUPICAPRA, or chamois-goat, has erect and hooked horns. The body is of a duſky red colour; but the front, top of the head, gullet, and inſide of the ears, are white; the under part of the tail is blackiſh; and the upper lip is a little divided. It inhabits the Alps of Dauphine, Switzerland, and Italy; the Pyrenean mountains; Greece, and Crete: does not dwell ſo high in the hills as the ibex, and is found, in greater numbers.

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The chamois is of the ſize of a domeſtic goat, and his hair is as ſhort as that of a hind. His vivacity is delightful, and his agility truly admirable. Theſe animals are very ſocial among themſelves: We find them going in pairs, or in little flocks of from three to twenty; and ſometimes we ſee from 60 to 100 of them diſperſed in different flocks along the declivity of the ſame mountain. The large males keep at a diſtance from the reſt except in the rutting ſeaſon, when they join the females, and beat off all the young. At this period, their ardour is ſtill ſtronger than that of the wild bucks. They bleat often, and run from one mountain to another. Their ſeaſon of love is in the month of October and November, and they bring forth in March and April. A young female takes the male at the age of 18 months. The females bring forth one, but rarely two at a time. The young follow their mothers till October, if not diſperſed by the hunters or the wolves. We are aſſured that they live between 20 and 30 years. Their fleſh is very good. A fat chamois goat will yield from 10 to 12 pounds of ſuet, which is harder and better than that of the goat. The blood of the chamois is extremely hot, and it is ſaid, to have qualities and virtues nearly equal to thoſe of the wild goat. The hunters ſometimes mix the blood of the wild and chamois goat: At other times they ſell the blood of the wild goats for that of the chamois. The voice of the chamois is a very low and almoſt imperceptible kind of bleating, reſembling that of a hoarſe domeſtic goat. It is by this bleating that they collect together, particulary the mothers and their young. But, when alarmed, or when they perceive their enemy, or any thing the nature of which they cannot diſtinguiſh, they advertiſe one another by a kind of whiſtling noiſe. The ſight of the chamois is very penetrating, and his ſenſe of ſmelling is acute. When the ſees a man diſtinctly, he ſtops for ſome time, and flies off when he makes a nearer approach. His ſenſe of hearing is equally acute as that of ſmelling; for he hears the ſmalleſt noiſe. When the wind blows in the direction between him and a man, he will perceive the ſcent at the diſtance of more than half a league. Hence, when he ſmells or hears any thing which he cannot ſee, he whiſtles or blows with ſuch force, that the rocks and foreſts re-echoe the ſound. If there are many of them near, they all take the alarm. This whiſtling is as long as the animal can blow without taking breath. It is firſt ſharp, and turns flat at the end. The chamois then ſtops for a moment, looks round on all ſides, and begins whiſtling afreſh, which he continues from time to time. His agitation is extreme. He ſtrikes the earth with his feet; he leaps upon the higheſt ſtones he can find; he again looks round, leaps from one eminence to another; and, when he diſcovers any thing, he flies off. The whiſtling of the male is ſharper than that of the female. This whiſtling is performed through the noſtrils, and conſiſts of a ſtrong blowing, ſimilar to the ſound which a man may make by fixing his tongue to the palate, with his teeth nearly ſhut, his lips open, and ſomewhat extended, and blowing long and with great force. The chamois feeds on the fineſt herbs. He ſelects the moſt delicate parts of plants, as the flowers and the tendereſt buds. He is very fond of ſome aromatic herbs, particularly of the carline thiſtle and genipay, which are

are the hotteſt plants that grow in the Alps. When he eats green herbs, he drinks very little. He is very fond of the leaves and tender buds of ſhrubs. He ruminates like the common goat. The food he uſes ſeems to announce the heat of his conſtitution. This animal is admired for his large round eyes, whoſe ſize correſponds with the vivacity of his diſpoſition. His head is adorned with two ſmall horns, from half a foot to nine inches in length. Their colour is a fine black, and they are placed on the front nearly between his eyes; and, inſtead of being reflected backward, like thoſe of other animals, they advance forward above the eyes, and bend backward at the points, which are extremely ſharp. He adjuſts his ears moſt beautifully to the points of his horns. Two tufts of black hair deſcend from his horns to the ſides of his face. The reſt of the head is of a yellowiſh white colour, which never changes. The horns of the chamois are uſed for the heads of canes. Thoſe of the female are ſmaller and leſs crooked. The ſkin of the chamois, when dreſſed, is very ſtrong, nervous, and ſupple, and makes excellent riding-breeches, gloves, and veſts. Garments of this kind laſt long, and are of great uſe to manufacturers. The chamois goats are ſo impatient of heat, that, in ſummer, they are only to be found under the ſhades of caverns in the rocks, among maſſes of congealed ſnow and ice, or in elevated foreſts on the northern declivities of the moſt ſcabrous mountains, where the rays of the ſun ſeldom penetrate. They paſture in the mornings and evenings, and ſeldom during the day. They traverſe the rocks and precipices with great facility, where the dogs dare not follow them. There is nothing more worthy of admiration than to ſee theſe animals climbing or deſcending inacceſſible rocks. They neither mount nor deſcend perpendicularly, but in an oblique line. When deſcending, particularly, they throw themſelves down acroſs a rock which is nearly perpendicular, and of 20 or 30 feet in height, without having a ſingle prop to ſupport their feet. In deſcending, they ſtrike their feet three or four times againſt the rock, till they arrive at a proper reſting-place below. The ſpring of their tendons is ſo great, that, when leaping about among the precipices, one would imagine they had wings inſtead of limbs. It has been alleged by ſome, but without foundation, that the chamois, in climbing and deſcending rocks, ſupports himſelf by his horns. It is by the ſtrength and agility of his limbs that the chamois is enabled to climb and deſcend rocks. His legs are very free and tall; thoſe behind are ſomewhat longer, and always crooked, which favours their ſpringing to a great diſtance; and, when they throw themſelves from a height, the hind legs receive the ſhock, and perform the office of two ſprings in breaking the fall. In great ſnows, and during the rigour of winter, the chamois goats inhabit the lower foreſts, and live upon pine leaves, the buds of trees, buſhes, and ſuch green or dry herbs as they can find by ſcratching off the ſnow with their feet. The foreſts that delight them moſt, are thoſe which are very full of rocks and precipices. The hunting of the chamois is very difficult and laborious. The mode moſt in uſe is to kill them by ſurpriſe. The hunters conceal themſelves behind rocks or large ſtones, taking care that the wind blows oppoſite to them, and, when a favourable opportunity occurs, ſhoot them with muſket-balls. They are likewiſe hunted in the ſame manner as ſtags and other animals, by poſting ſome of the hunters in narrow paſſages, while others beat about to raiſe the game. Men are preferable for this purpoſe to dogs; for dogs too quickly diſperſe the animals, who fly off ſuddenly to the diſtance of four or five leagues.

V. The DEPRESSA is an African goat, with ſmall depreſſed horns, bent inwards, lying on the head. It is about the ſize of a kid; and the hair is long and pendulous.

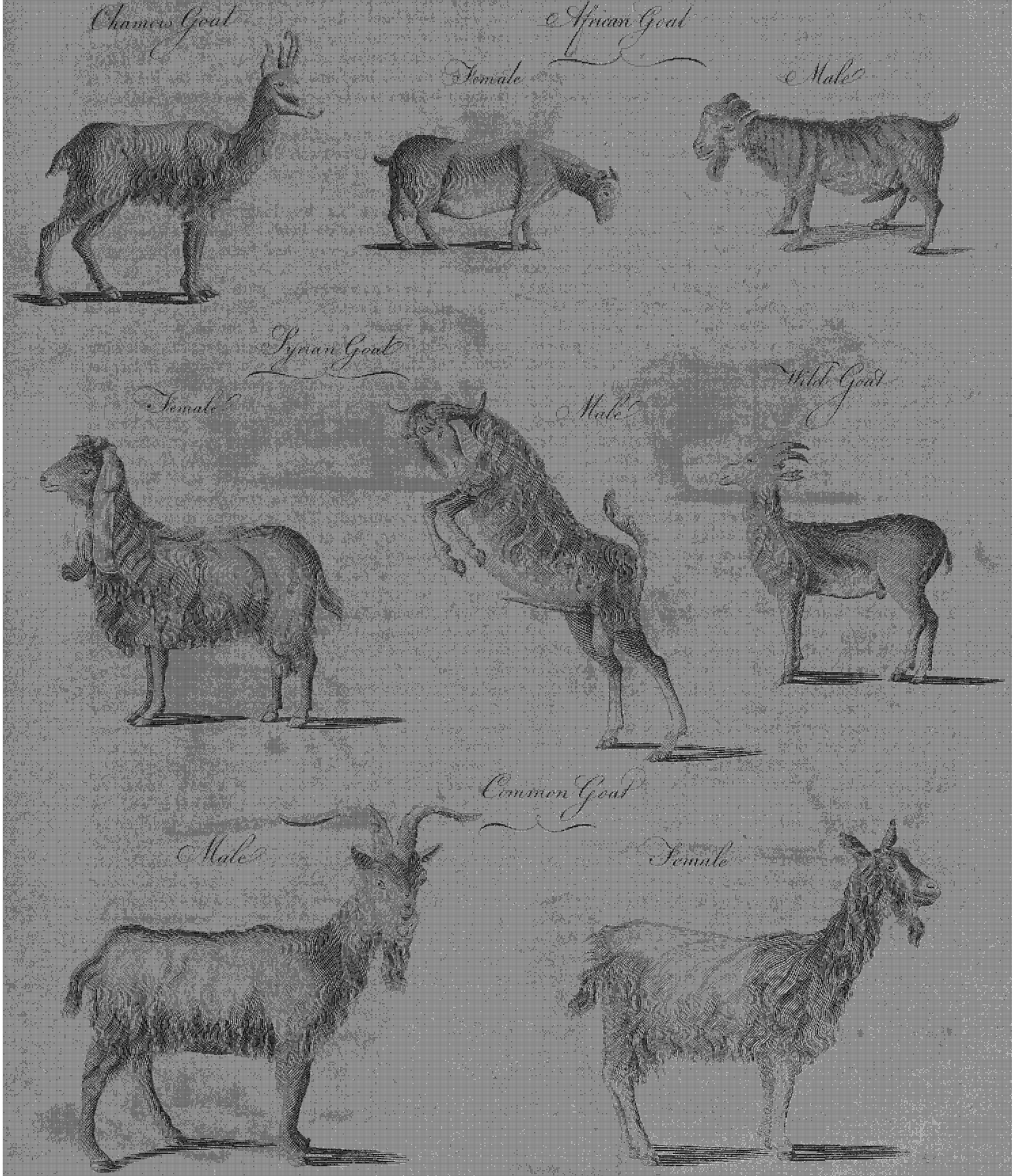
VI. The REVERSA is likewiſe an African goat, with erect horns, and curved a little forwards. It is about the ſize of a kid of a year old. It inhabits Juda or Whidaw in Africa.

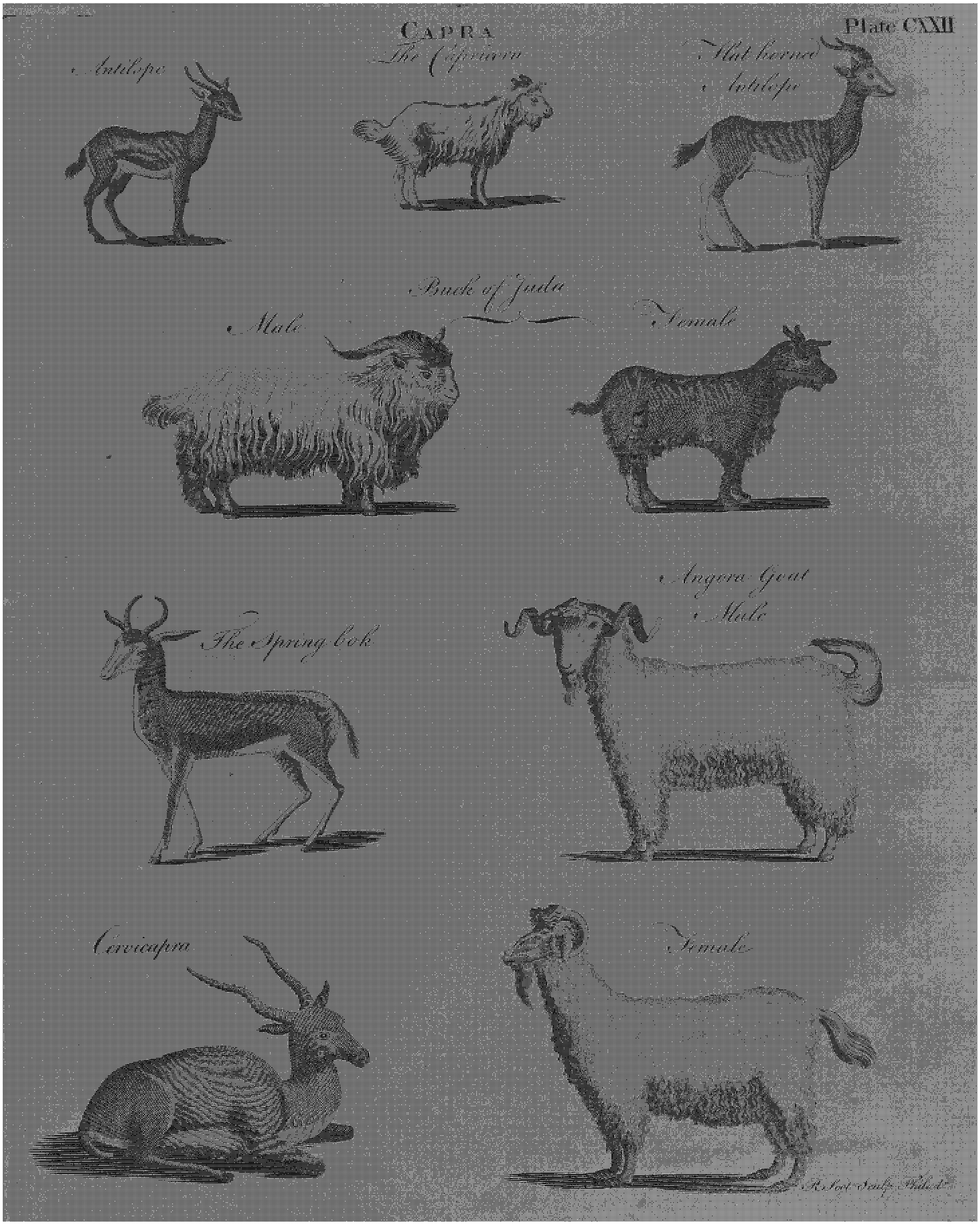
VII. The GAZELLA has long, erect, cylindrical horns, annulated near the baſe. It inhabits Egypt, the Cape, Arabia, the Levant, and India, dwelling in the plains.

VIII. The CERVICAPRA, with plated cylindrical horns, inhabits Barbary. The hair near the horns is longer than in any other part of the body. The females want horns. Mr Haſſelqueſt gives the following account of this ſpecies: "The cervicapra is larger ſwifter, and wilder, than the common rock-goat, and can ſcarcely be taken without a falcon. It is met with near Aleppo. I have ſeen a variety of this which is common in the Eaſt, and the horns appear different; perhaps it is a diſtinct ſpecies. This animal loves the ſmoke of tobacco; and, when caught alive, will approach the pipe of the huntſman, though otherwiſe more timid than any animal. This is perhaps the only creature, beſides man, that delights in the ſmell of a poiſonous and ſtinking plant. The Arabians hunt it with a falcon (*falco gentilis*, Lin.) I had an excellent opportunity of ſeeing this ſport near Nazareth in Galilee. An Arab, mounted on a ſwift courſer, held the falcon in his hand, as huntſmen commonly do: when he eſpied the rock-goat on the top of the mountain, he let looſe the falcon, which flew in a direct line like an arrow, and attacked the animal; fixing the talons of one of his feet into the cheek of the creature, and the other into its throat, extending his wings obliquely over the animal; ſpreading one towards one of its ears, and the other to the oppoſite hip. The animal, thus attacked, made a leap twice the height of a man, and freed himſelf from the falcon: but being wounded, and loſing his ſtrength and ſpeed, he was again attacked by the falcon; which fixed the talons of both its feet into the throat of the animal, and held it faſt, till the huntſman coming up, took it alive, and cut its throat; the falcon drinking the blood as a reward for his labour. A young falcon, which was learning, was likewiſe put to the throat of the goat: by this means are young falcons taught to fix their talons in the throat of the animal, as being the propereſt part; for ſhould the falcon fix them in the creature's hip, or ſome other part of the body, the huntſman would not only loſe his game, but his falcon alſo: for the animal, rouſed by the wound, which could not prove mortal, would run to the deſerts and the tops of the mountains, whither its enemy, keeping its hold, would be obliged to follow; and, being ſeparated from its maſter, muſt of courſe periſh."

IX. The

CAPRA Plate CXXI




CAPRA
Plate CXXII
Antilope
The Capricorn
Flat horned Antilope
Buck of Juda
Male
Female
Angora Goat
Male
The Spring bok
Cervicapra
Female
R. Scot Sculp. Philad.

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IX. The BEZOARTICA, or bezoar goat, is bearded, and has cylindrical, arched, and wholly annulated horns. It is a native of Perſia. The bezoar is found in one of its ſtomachs, called *abomaſus*. See BEZOAR and ABOMASUS.

X. The TARTARICA, or ſaiga of Buffon, has cylindrical, ſtraight, annulated horns; the points inclining inward, the ends ſmooth; the other part ſurrounded with very prominent annuli; of a pale yellow colour; and the greateſt part ſemipellucid; the cutting teeth are placed ſo looſe in their ſockets, as to move with the leaſt touch. The male is covered with rough hair like the he-goat, and has a very ſtrong ſmell; the female is ſmoother. The hair on the bottom of the ſides and the throat is long, and reſembles wool; that on the ſides of the neck and head is hoary; the back and ſides of a dirty white; the breaſt, belly, and inſide of the thighs, of a ſhining white. The females are deſtitute of horns. Theſe animals inhabit all the deſerts from the Danube and Dnieper to the river Irtiſh, but not beyond. Nor are they ever ſeen to the north of 54 or 55 degrees of latitude. They are found therefore in Poland, Moldavia, about Mount Caucaſcus, and the Caſpian Sea, and Siberia, in the dreary open deſerts, where ſalt-ſprings abound, feeding on the ſalt, the acrid and aromatic plants of thoſe countries, and grow in the ſummer-time very fat: but their fleſh acquires a taſte diſagreeable to many people, and is ſcarcely eatable, until it is ſuffered to grow cold after dreſſing. The females go with young the whole winter; and bring forth in the northern deſerts in May. They have but one at a time; which is ſingular, as the numbers of theſe animals are prodigious. The young are covered with a ſoft fleece, like new-dropt lambs, curled and waved. They are regularly migratory. In the rutting-ſeaſon, late in autumn, they collect in flocks of thouſands, and retire into the ſouthern deſerts. In the ſpring they divide into little flocks, and return northward at the ſame time as the wandering Tartars change their quarters.

They very ſeldom feed alone; the males feeding promiſcuouſly with the females and their young. They rarely lie down all at the ſame time: but, by a providential inſtinct, ſome are always keeping watch; and when they are tired, they ſeemingly give notice to ſuch as have taken their reſt, who ariſe inſtantly, and as it were relieve the centinels of the preceeding hours. They thus often preſerve themſelves from the attack of wolves, and from the ſurprize of the huntſmen. They are exceſſively ſwift, and will outrun the fleeteſt horſe or grey-hound; yet partly through fear (for they are the moſt timid of animals), and partly by the ſhortneſs of their breath, they are very ſoon taken. If they are but bit by a dog, they inſtantly fall down, nor will they even offer to riſe. In running they ſeem to incline on one ſide, and their courſe is ſo rapid that their feet ſeem ſcarcely to touch the ground. In a wild ſtate they ſeem to have no voice. When brought up tame, the young emit a ſhort ſort of bleating, like ſheep.

The males are moſt libidinous animals: the Tartars, who have ſufficient time to obſerve them, report that they will copulate twenty times together; and that this ability ariſes from their feeding on a certain herb, which has moſt invigorating powers. When taken young, they may eaſily be made tame; but if caught when at full age, are ſo wild and ſo obſtinate as to refuſe all food. When they die, their noſes are quite flaccid.

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They are hunted for the ſake of their fleſh, horns, and ſkins, which are excellent for gloves, belts, &c. The huntſmen always approach them againſt the wind, leaſt they ſhould ſmell their enemy; they alſo avoid putting on red or white clothes, or any colours which might attract their notice. They are either ſhot, or taken by dogs; or by the black eagle, which is trained to this ſpecies of falconry. Their beſt ſeaſon is in September: at other times, the ſkins are penetrated by worms. The fat reſembles that of mutton; in taſte, like that of a buck: the head is reckoned the moſt delicate part.

XI. The AMMON, has ſemicircular, plain, white horns, and no beard. It is about the ſize of a ram, and is a native of Siberia.

XII. The ÆEGAGRUS of Pallas, or Caucaſan goat, has ſmooth black horns, ſharply ridged on their upper parts, and hollowed on their outward ſides. No veſtiges of knots or rings, but on the upper ſurface are ſome wavy riſings; bend much back, and are much hooked at the end, approaching a little at the points. On the chin is a great beard, duſky, mixed with cheſnut. The fore-part of the head is black, the ſides mixed with brown: the reſt of the animal grey, or grey mixed with ruſt-colour. Along the middle of the back, from the neck to the tail, is a black liſt; and the tail is black.

The female is either diſtitute of horns, or has very ſhort ones. In ſize it is ſuperior to the largeſt he-goats, but in form and agility reſembles a ſtag: yet Monardus compares it to the he-goat, and ſays that it has the feet of the goat. They inhabit the lower mountains of Caucaſus and Taurus, all Aſia Minor, and perhaps the mountains of India. They abound on the inhoſpitable hills of Laar and Khorazan in Perſia; and according to Monardus are alſo found in Africa. It is an animal of vaſt agility. Monardus was witneſs to the manner of its ſaving itſelf from injury by falling on its horns; for he ſaw that which he deſcribes leap from a high tower, precipitating itſelf on its horns; then ſpringing on its legs, and leaping about, without receiving the leaſt harm. This is one of the animals which yields the once-valued alexipharmic, the Bezoar-ſtone; which is a concretion formed of many coats, incruſting a nucleus of ſmall pebble, ſtones of fruits, bits of ſtraw, or buds of trees. The incruſting coats are created from the vegetable food of the animals, eſpecially the rich, dry, and hot herbs of the Perſian and Indian mountains. Its virtues are now exploded, and it is reckoned only an abſorbent, and that of the weakeſt kind.

XIII. GNOU, with ſcabrous horns, and thick at the baſe, bending forward cloſe to the head, then ſuddenly reverting upwards. The mouth is ſquare; the noſtrils covered with broad flaps. From the noſe, half way up the front, is a thick oblong-ſquare bruſh of long ſtiff black hairs reflected upwards, on each ſide of which the other hairs are long, and point cloſely down the cheek. Round the eyes are diſpoſed in a radiated form ſeveral ſtrong hairs. The neck is ſhort, and a little arched. On the top a ſtrong and upright mane, reaching from the horns beyond the ſhoulders. On the

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the chin is a long white beard; and on the gullet a very long pendulous bunch of hair. On the breast, and between the fore-legs, the hairs are very long and black. The tail reaches to the first joint of the legs, and is full of hair like that of a horse, and quite white. The body is thick; and covered with smooth short hair of a rust brown colour tipt with white. The legs are long, elegant, and slender, like those of a stag. On each foot is only a single spurious or hind hoof.—It is a strange compound of animals: having a vast head like that of an ox; body and tail, like a horse; legs like a stag; and the sinus lacrymalis of an antelope. The ordinary size of it is about that of a common galloway; the length of it being somewhat above five, and height of it rather more than four feet.—These animals inhabit in great numbers the fine plains of the great Namacquas, far north of the Cape of Good Hope, extending from S. lat. 25. to 28. 42. where Africa seems at once to open its vast treasures of hoofed quadrupeds. It is an exceedingly fierce animal: on the sight of any body it usually drops its head and puts itself into an attitude of offence; and will dart with its horns against the pales of the inclosure towards the persons on the outside; yet it will afterwards take the bread which is offered. It will often go upon its knees, run swiftly in that singular posture, and furrow the ground with its horns and legs. The Hottentots call it *Gnou* from its voice. It has two notes, one resembling the bellowing of an ox, the other more clear. It is called an ox by the Europeans.

XIV. The DORCAS, or antelope, has cylindrical annulated horns, bent backward, contorted, and arising from the front between the eyes. It is a native of Africa and Mexico. These animals are of a most elegant and active make; of a restless and timid disposition; extremely watchful; of great vivacity; remarkably swift; exceedingly agile; and most of their boundings so light, so elastic, as to strike the spectator with astonishment. What is very singular, they will stop in the middle of their course, for a moment gaze at their pursuers, and then resume their flight.

As the chase of these animals is a favourite diversion with the eastern nations, from that may be collected proofs of the rapid speed of the antelope tribe. The grey-hound, the fleetest of dogs, is unequal in the course; and the sportsman is obliged to call in the aid of the falcon trained to the work, to seize on the animal and impede its motions, to give the dogs time to overtake it. In India and Persia a sort of leopard is made use of in the chase: this is an animal that takes its prey, not by swiftness of foot, but by the greatness of its springs, by motions similar to that of the antelope; but should the leopard fail in its first essay, the game escapes.

The fleetness of this animal was proverbial in the country it inhabited even in the earliest times: the speed of Asahel is beautifully compared to that of the tzebi; and the Gadites were said to be as swift as the roes upon the mountains. The sacred writers took their similes from such objects as were before the eyes of the people they addressed themselves to. There is another instance drawn from the same subject: the disciple raised to life at Joppa was supposed to have been called *Tabitha*, i. e. *Dorcas*, or the *Antelope*, from the beauty of her eyes; and this is still a common comparison in the east: *Aine el Czazel*, or, "You have eyes of an Antelope," is the greatest compliment that can be paid to a fine woman.

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Some species of the antelopes form herds of 2000 or 3000, while others keep in small troops of five or six. They generally reside in hilly countries; though some inhabit plains: they often browse like the goat, and feed on the tender shoots of trees, which give their flesh an excellent flavour. This is to be understood of those that are taken in the chase; for those that are fattened in houses are far less delicious. The flesh of some species are said to taste of musk, which perhaps depends on the qualities of the plants they feed on.

Mr Pennant makes the antelope a distinct genus of animals, forming a link between the goat and the deer; with the first of which they agree in the texture of the horns which have a core in them, and they never cast them; with the last, in the elegance of their form, and great swiftness. He distinguishes several species, among which he ranks the *gazella*, the *cervicapra*, the *bezoartica*, and the *tartarica* of Linnæus, described above, VII. VIII. IX. X. with the *moschus grimmia* of the same author. See MOSCHUS.

The other species of antelopes distiguished by zoologists are:

1. Kevella of Pallas, or flat-horned antelope, has horns twelve inches long, flattened on their sides, inclining first backwards, bending in the middle, and then reverting forwards, at their ends, and annulated with from fourteen to eighteen rings: the upper side of the body is reddish brown; the lower part and buttocks are white: the size equal to a small roebuck. They inhabit Senegal; where they live in great flocks, are easily tamed and are excellent meat.

2. The corine antelope, with very slender horns, six inches long, surrounded with circular *rugæ*: on each side of the face is a white line: beneath that, is one of black: the neck, body, and flanks are tawny; belly and inside of the thighs white, on the knees is a tuft of hair. It is less than a roebuck, and inhabits Senegal.

3. The nagor, or red antelope, with horns $5\frac{1}{2}$ inches long; one or two slight rings at the base: ears much longer than the horns: hair stiff and bright; in all parts of a reddish colour, palest on the chest: tail very short. Inhabits Senegal and the Cape; where it is very frequent, and is a common food.

4. The dama or swift antelope (*le Nanguer*, Buff.), with round horns, eight inches long, reverting at their ends. The general colour is tawny; but this species varies in that particular. It inhabits Senegal; and is easily tamed. It is very swift: Ælian compares its flight to the rapidity of a whirlwind.

5. The elk-antelope of Sparman (Indian antelope of Pennant), has thick straight horns, marked with two prominent spiral ribs near two-thirds of their length, smooth towards their end; some above two feet long. The head is of a reddish colour, bounded on the cheeks by a dusky line. The forehead is broad; the nose pointed. On the forehead is a stripe of long loose hairs; and on the lower part of the dewlap, a large tuft of black hair. Along the neck and back, from head to tail, is a black short mane: the rest of the body is of a bluish grey, tinged with red. The tail does not reach to the first joint of the leg; is covered with short

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Capra.

cinereous hair; and the end tufted with long black hairs. The hoofs are ſhort, ſurrounded at their junction with the legs by a circle of black hairs. The height to the ſhoulders is five feet. It is thick bodied and ſtrongly made; but the legs are ſlender. It wants the *ſinus lachrymalis*. The females are horned like the males.—The Caffres call this ſpecies *empoſos* and *poſſo*. The Dutch of the Cape call it the *eland* or *elk*. M. de Buffon, by miſtake, calls this the *condous*, which he ought to have beſtowed on his *condoma*. It inhabits India, Congo, and the ſouthern parts of Africa. They live in herds; but the old males are often ſolitary. They grow very fat, eſpecially about the breaſt and heart: ſo that they are eaſily caught; and when purſued, will ſometimes fall dead in the chaſe. They are ſlow runners: when rouſed, always go againſt the wind, nor can the hunters (even if they front the herd) divert them from their courſe. The fleſh is fine grained, very delicious, and juicy. The hide is tough: the Hottentots make tobacco-pipes of the horns.

6. The cervine antelope, or *antelope bubalis* of Pallas, with horns bending outward and backward, almoſt cloſe at their baſe, and diſtant at their points; twiſted and annulated; very ſtrong and black: the head is large, and like that of an ox: the eyes are placed very high, and near to the horns: the form of the body is a mixture of the ſtag and heifer; height to the top of the ſhoulders four feet: the tail is rather more than a foot long, aſinine, and terminated with a tuft of hair: the colour a reddiſh brown; white about the rump, the inner ſide of the thighs, and lower part of the belly: a dark ſpace occupies the top of the back, the front of the upper part of the fore legs, and hinder part of the thighs. It inhabits Barbary, and probably other parts of Africa, being alſo found towards the Cape of Good Hope. It is the *bekker el waſh* of the Arabs, according to Dr Shaw; who ſays, that its young quickly grow tame, and herd with other cattle. Mr Foſkal mentions it among the Arabian animals of an uncertain genus, by the name of *bakar uaſch*. This is the bubalus of the ancients; not the buffalo, as later writers have ſuppoſed. The Dutch of the Cape call this ſpecies *hartebeeſt*. They go in great herds; few only are ſolitary. They gallop ſeemingly with a heavy pace, yet go ſwiftly. They drop on their knees to fight like the white-footed antelope or nil-ghau, and the boſch-bok, after-deſcribed. The fleſh is fine grained but dry.—Mr Sparman informs us, that in this animal there is a pore one line in diameter, an inch or an inch and a half below and before the internal angle of the eye. From this pore, which is the aperture of a caruncle that lies below, there is ſecreted a matter almoſt like ear-wax, which he obſerved the Hottentots kept in a piece of ſkin as a rare and excellent medicine; on the dried ſkin of the animal, this pore is ſcarcely to be diſcerned. This Mr Sparman ſuppoſes is the reaſon why ſo great and accurate a zoologiſt as M. Pallas (who deſcribes it in his *Spicilegia* under the denomination of *Antilope bubalis*) makes no mention of this pore, as he made his deſcriptions chiefly from the dried ſkins of this animal. The uſe of this pore, which is alſo found in the deer, is for affording freer reſpiration, a circumſtance ſo eſſential to beaſts of chaſe. See Cervus.

7. The ſpringer, with ſlender horns, annulated half way, and twice contorted. The ears very long and duſky. The face, cheeks, noſe, chin, and throat, are white. The whole upper ſide of the neck, part of the lower, the back, ſides, and outſide of the limbs, are of a pale yellowiſh brown. The cheſt, belly, and inſide of the limbs, are white; the ſides and belly divided by a broad band of cheſnut, which runs down part of the ſhoulders. The tail reaches to the firſt joint of the leg; the upper part white; the lower black, and furniſhed with long hair. The buttocks are white; and from the tail half way up the back is a ſtripe of white, expanſible at pleaſure. This elegant ſpecies weighs about fifty pounds, and is rather leſs than a roebuck. It inhabits the Cape of Good Hope, where it is called the *ſpring-bock*, from the prodigious leaps it takes on the ſight of any body. When alarmed, it has the power of expanding the white ſpace about the tail into the form of a circle, which returns to its linear form when the animal is tranquil. Theſe animals migrate annually from the interior parts in ſmall herds, and continue in the neighbourhood of the Cape for two or three months: then join companies, and go off in troops conſiſting of many thouſands, covering the great plains for ſeveral hours in their paſſage. They are attended in their migrations by numbers of lions, hyænas, and other wild beaſts, which make great deſtruction among them. They are excellent eating, and with other antelopes are the veniſon of the Cape. Mr Maſon* informs us, that they alſo make periodical migrations, in ſeven or eight years, in herds of many hundred thouſands, from the north, as he ſuppoſes from the interior parts of *Terra de Natal*. They are compelled to it by the exceſſive drought which happens in that region, when ſometimes there does not fall a drop of rain for two or three years. Theſe animals in their courſe deſolate Caffraria, ſpreading over the whole country, and not leaving a blade of graſs. Lions attend them; where one of thoſe beaſts of prey are, his place is known by the vaſt void viſible in the middle of the timorous herd.

* *Phil. Tranſ.* vol. lxvi. p. 103.

8. The ſtriped antelope, has ſmooth horns, twiſted ſpirally, and compreſſed ſideways, with a ridge on one ſide following the wreaths: they conſiſt of three bends; and are ſometimes four feet and a half long meaſured in a ſtraight line. They are naturally of a duſky colour, and wrinkled; but are generally brought over highly poliſhed. The females are deſtitute of horns. In the upper jaw is a hard horny ſubſtance, diſpoſed in ridges. The length of the animal is nine feet; the legs are ſlender: the general colour is of a reddiſh caſt, mixed with grey; and from the tail, along the top of the back, to the ſhoulders, is a white ſtripe; from which are ſeven others, four pointing towards the thighs, and three towards the belly; but they vary in number of ſtripes. On the upper part of the neck is a ſhort mane: beneath the neck, from the throat to the breaſt, are ſome long hairs hanging down. It inhabits the Cape of Good Hope, where it is called *coedoes*, and is ſaid to leap to a moſt aſtoniſhing height. This ſpecies wants the *ſinus lachrymalis*.

9. The boſch-bok, or wood-goat of the Cape, a ſpecies of antelope, according to Mr Sparman, unknown to all the cultivators of natural hiſtory, whether ancient or modern, till he deſcribed it in the memoirs of the Swediſh academy for the year 1780, quarter 3d, by the name of *antilope ſylvatica*. This animal



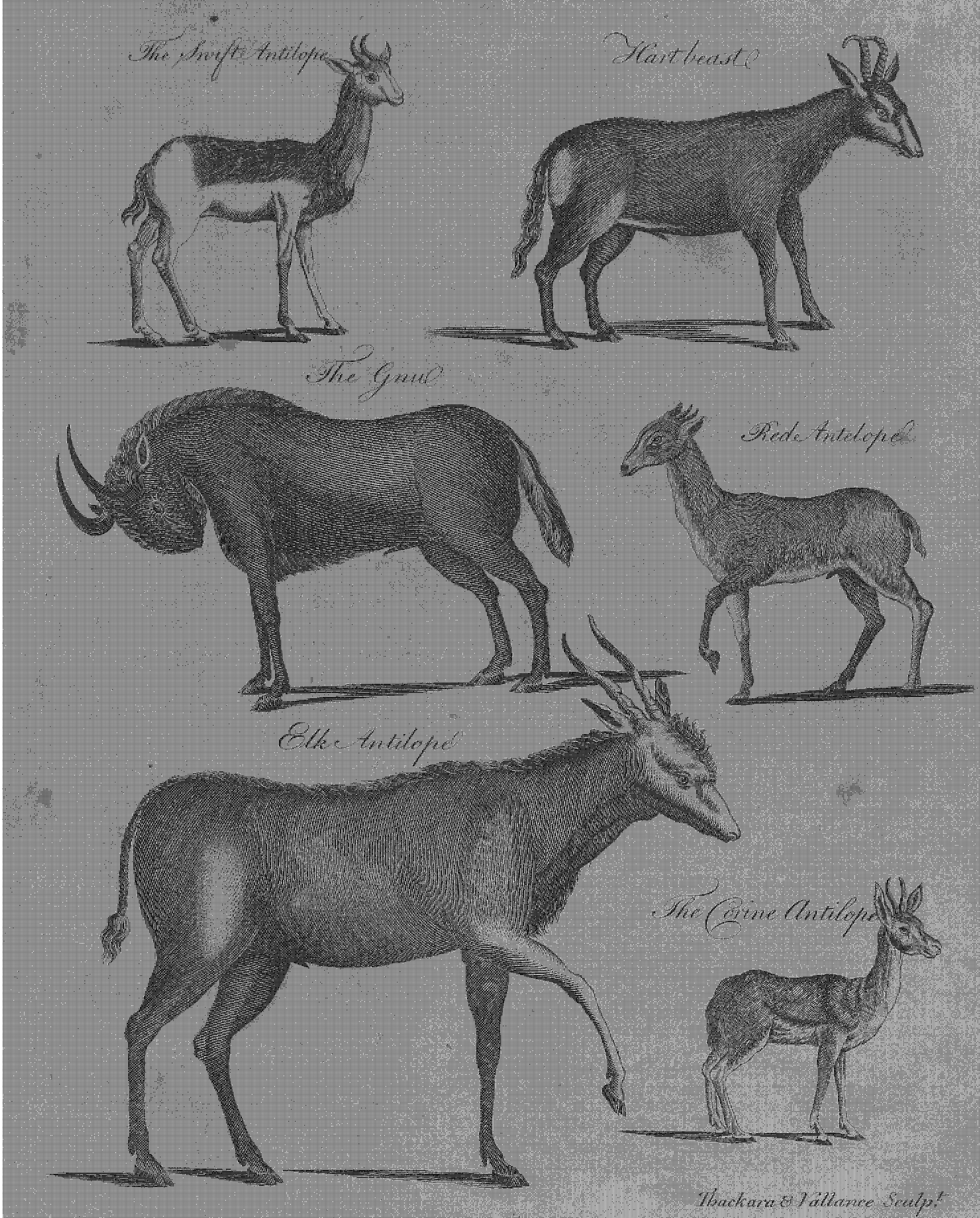
has

has obtained the name it goes by, in consequence of its being the only one among the gazels in Africa, which may be properly said to live in the woods and groves. In size, the bosch-bok is somewhat above two feet and a half high. The horns are ten inches and a half long; the ears half the length of the horns, or five inches.—The horns are black, in some measure triangular, and at the same time wreathed, so that both the sides and angles have somewhat of a spiral turn. At bottom they are rather rough, in consequence of a set of almost innumerable wavy-rings; which, however, are not elevated much above the surface. At top they are conical and sharp-pointed, and in that part as smooth as though they had been polished. The teeth of this animal are like those of other antelopes. It has no fore-teeth or *incisores* except in the lower jaw, where it has eight.—There is no *porus ceriferus* in this, as there is in some other antelopes. The hairs on the head are very short and fine; afterwards they become more rough and rugged, resembling goats hair more than that of gazels or harts. Forwards on the neck, breast, sides, and belly, they are an inch and a half or two inches long. On the ridge of the neck, and so on all along that of the back, they are three or four inches in length, so as to form a kind of mane there, terminating in a tail about a finger's breadth long. On the hind part of the thighs and buttocks likewise, the hairs are eight inches long; the legs and feet are slender, and covered with short hairs; the fetlock-joints are small; the nose and under-lip are decorated with black whiskers about an inch long. The predominant colour in this animal is dark-brown, which occupies the principal part of the sides, the back, the upper part of the tail, the upper part of the chest and fore-ribs, and the fore-part of the belly. A still darker brown, bordering upon black, is discoverable on the outside of the shoulders, and some part of the fore-ribs. The fore-part of the nose, from the eyes to the muzzle, is of a soot colour. The ears are likewise as black as soot on the outside, but on the inside grey; and both outwards and inwards covered with hairs still shorter than those on the head; excepting half the fore-part of the lower edge, where the hairs are white and half an inch long. Divers small white spots, from nine to twelve in all, are seen on each of the haunches and on the sides near them. A narrow line of long white hairs extends from the neck all along the back and tail, in the midst of the long brown hairs already described. From the chine of the back to the sides run five white parallel streaks, which, however, are only discoverable by a close inspection.

This creature does much mischief to the vineyards and kitchen-gardens of the Cape colonists; and it shows a great deal of craft and artifice in avoiding the snares and traps set for it, as well as the ambuscades of the sportsmen. As the *bosch-bok* runs but slowly, it sometimes happens that he is caught by dogs. When he sees there is no other resource, he puts himself in a posture of defence; and when he is going to butt, kneels down, like the white-footed antelope and the hartbeest. The colonists are not very fond of hunting him in this manner, as the beast on this occasion generally sells his life at a very dear rate, by goring and killing some of their best and most spirited hounds. This creature's horns, which are its chief defence, sometimes also prove its bane, by being entangled in the bushes and small branches of trees, which thus stop the beast in its flight. In some measure to avoid this, it carries its nose horizontally and straight forward while it runs; so that its horns lie, as it were, directly on its neck: notwithstanding which, their horns are generally worn away a little on the fore-part, and thus acquire some degree of polish.—This species of antelope is monogamous, or keeps in pairs. It is swifter in woodlands than the dogs, which likewise sooner lose scent of him there. The female, which is without horns, and on that account runs about in the forest more free and unimpeded, does not suffer herself so easily to be hunted out of the woods, having there, as well as on the plains, a more certain defence against the dogs in her legs, than the male has in his horns, especially as she is not so bulky and heavy as the male. Her breast is said to be very plump and fleshy, but the flesh in general is not very tender.

10. The leucoryx with the nose thick and broad, like that of a cow; the ears somewhat slouching; body clumsy and thick: The horns long, very slightly incurvated, slender, annulated part of the way; black, pointed. The tail reaching to the first joint of the legs, and tufted. The colour is in all parts a snowy whiteness, except the middle of the face, sides of the cheeks, and limbs, which are tinged with red.—This species is about the size of a Welch runt; and inhabits Gow Bahrein, an isle in the gulph of Bassora.

11. The picta, white-footed antelope, or nyl-ghau; with short horns, bending a little forward; ears large, marked with two black stripes; a small black mane on the neck, and half way down the back: a tuft of long black hairs on the fore-part of the neck; above that, a large spot of white; another between the fore-legs on the chest: one white spot on each fore-foot; two on each hind-foot: the tail is long, tufted with black hairs. The colour of the male is a dark grey. The female is of a pale brown colour; with a mane, tuft, and striped ears, like the male; on each foot three transverse bands of black and two of white: It is destitute of horns. The height to the top of the shoulders is four feet and an inch; the length from the bottom of the neck to the anus, four feet. The head is like that of a stag; the legs are delicate.—These animals inhabit the distant and interior parts of India, remote from the settlements. They are brought down as curiosities to the Europeans, and have of late years been frequently imported into England. In the days of Aurenge Zebe, they abounded between Delhi and Lahor, on the way to Cachemire. They were called *nyl-ghau*, or *blue* or *grey bulls*; and were one of the objects of chase, with that mighty prince, during his journey. They were inclosed by his army of hunters within nets, which being drawn closer and closer, at length formed a small precinct: into this the king, his omrahs, and hunters, entered, and killed the beasts with arrows, spears or muskets; and sometimes in such numbers, that Aurenge Zebe used to send quarters as presents to all his great people. They are usually very gentle and tame, will feed readily, and lick the hands which give them food. In confinement they will eat oats, but prefer grass and hay; are very fond of wheaten bread; and when thirsty, they will drink two


The Swift Antilope
Hart beast
The Gnu
Red Antelope
Elk Antilope
The Corine Antilope
Thackara & Vallance Sculp.

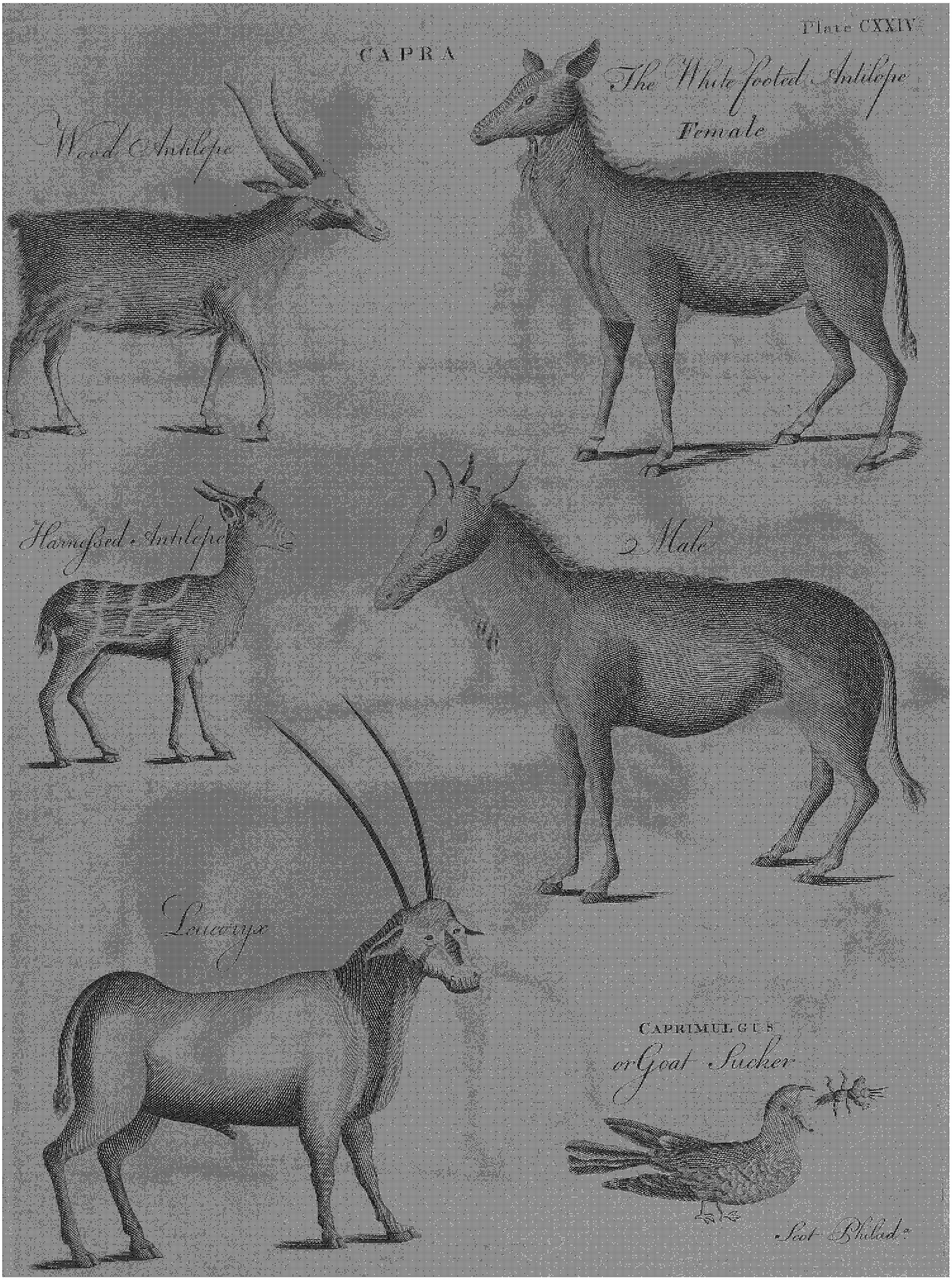


Plate CXXIV.
CAPRA
The White footed Antilope
Female
Wood Antilope
Harnessed Antilope
Male
Leucoryx
CAPRIMULGUS
or Goat Sucker
Scot Philad.

two gallons at a time. They are said to be at times very vicious and fierce. When the males fight, they drop on their knees at a distance from one another, make their approaches in that attitude, and when they come near, spring and dart at each other. They will ofen, in a state of confinement, fall into that posture without doing any harm. They will, notwithstanding, attack mankind unprovoked. A labourer, who was looking over some pales which inclosed a few of them, was alarmed by one of the males flying at him like lightning; but he was saved by the intervention of the woodwork, which it broke to pieces, and at the same time one of its horns —They have bred in England, they are supposed to go nine months with young, and have sometimes two at a birth.

12. The scripta, or harnessed antelope (*leguib*, Buff.) has straight horns nine inches long, pointing backwards, with two spiral ribs. The general colour is a deep tawny; but the sides are most singularly marked with two transverse bands of white, crossed by two others from the back to the belly; the rump with three white lines pointing downwards on each side; and the thighs are spotted with white. The tail is ten inches long, covered with long rough hairs.—It inhabits the plains and woods of Senegal, living in large herds. It is frequent at the Cape, where it is called the *bonte-bok*, or *spotted goat*.

*Capra-Saltans*, in meteorology, a fiery meteor or exhalation sometimes seen in the atmosphere. It forms an inflected light, resembling in some measure the caperings of a goat; whence it has its name.

CAPRALA, an isle of Italy, in the Tuscan sea, to the north-east of Corsica, on which it depends. It is pretty populous, and has a strong castle for its defence. It is about 15 miles in circumference. E. Long. 11. 5. N. Lat. 43. 15.

CAPRARIA, in botany: 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 quinquepartite; the corolla campanulated, quinquefid, with acute segments; the capsule bivalved, bilocular, and polyspermous. There is but one species, the biflora, which is a native of the warm parts of America. Being a troublesome weed, and without beauty, it is never cultivated, except in botanic gardens for the sake of variety.

CAPRAROLA, one of the most magnificent palaces in Italy, seated on a hill, in Ronciglione, whose foot is watered by the river Tircia. It was built by cardinal Farnese; and has five fronts, in the middle of which is a round court, though all the rooms are square, and well proportioned. It is 27 miles north-west of Rome.

CAPREÆ. See Capri.

CAPREOLUS (Elias), an excellent civilian, and learned historian, born in Brescia in Italy, wrote an history of Brescia, and other works: died in 1519.

CAPRI, (anciently *Capreæ*), a city and island at the entrance of the gulph of Naples, E. Long. 14. 50. N. Lat. 40. 45.—The island is only four miles long and one broad; the city is a bishop's see, situated on a high rock at the west end of the island. Capreæ was anciently famous for the retreat of the emperor Tiberius for seven years, during which he indulged himself in the most scandalous debaucheries*. Before Tiberius came hither, Capri had attracted the notice of Augustus as a most eligible retreat, though in sight of populous cities, and almost in the centre of the empire. His successor preferred it to every other residence; and in order to vary his pleasures, and enjoy the advantages as well as avoid the inconveniences of each revolving season, built twelve villas in different situations, dedicated to the twelve greater gods: the ruins of some of them are still to be seen: at Santa Maria are extensive vaults and reservoirs; and on an adjoining brow are the remains of a light-house; two broken columns indicate the entrance of the principal court. According to Dion Cassius, this island was wild and barren before the Cæsars took it under their immediate protection: at this day a large portion of its surface is uncultivated and impracticable; but every spot that will admit the hoe is industriously tilled, and richly laden with the choicest productions of agriculture. The odium attached to the memory of Tiberius proved fatal to his favourite abode; scarce was his death proclaimed at Rome, when the senate issued orders for the demolition of every fabric he had raised on the island, which by way of punishment was thenceforward destined to be a state prison. The wife and sister of Commodus were banished to its inhospitable rocks, which were soon stained with their blood. In the middle ages Capri became an appendage of the Amalfitan republic, and after the downfall of that state, belonged to the duchy of Naples. There stood a pharos on this island, which, a few days before the death of Tiberius, was overthrown by an earthquake.



* See *Tiberius*.

CAPRIATA, (Peter John) a civilian and historian, was born at Genoa. He wrote in Italian, the history of the wars of Italy; an English translation of which was printed in London in 1663.

CAPRICORN, in astronomy, one of the 12 signs of the zodiac. See Astronomy, n° 404.

The ancients accounted Capricorn the tenth sign; and when the sun arrived thereat, it made the winter solstice with regard to our hemisphere: but the stars having advanced a whole sign towards the east, Capricorn is now rather the 11th sign; and it is at the sun's entry into Sagittary that the solstice happens, though the ancient manner of speaking is still retained.

This sign is represented on ancient monuments, medals, &c. as having the fore-part of a goat and the hind-part of a fish, which is the form of an Ægipan; sometimes simply under the form of a goat.

*Tropic of Capricorn*, a lesser circle of the sphere, which is parallel to the equinoctial, and at 23° 30′ distance from it southwards; passing through the beginning of Capricorn.

CAPRIFICATION, a method used in the Levant, for ripening the fruit of the domestic fig-tree, by means of insects bred in that of the wild fig-tree.

The most ample and satisfactory account of this curious operation in gardening are those of Tournefort and Pontedera: the former, in his Voyage to the Levant, and in a Memoir delivered to the academy of sciences at Paris in 1705; the latter, in the *Anthologia*. The substance of Tournefort's account follows; "Of the thirty species or varieties of the domestic fig-tree which are cultivated in France, Spain, and Italy, there

Caprification.

are but two cultivated in the Archipelago. The first species is called *ornos*, from the old Greek *erinos*, which answers to *caprificus* in Latin, and signifies a wild fig-tree. The second is the domestic or garden fig-tree. The former bears successively, in the same year, three sorts of fruit, called *fornites*, *cratitires*, and *orni*, which, though not good to eat, are found absolutely necessary towards ripening those of the garden-fig. These fruits have a sleek even skin; are of a deep green colour; and contain in their dry and mealy inside several male and female flowers placed upon distinct foot-stalks, the former above the latter. The *fornites* appear in August, and continue to November without ripening: in these are bred small worms, which turn to a sort of gnats, nowhere to be seen but about these trees. In October and November, these gnats of themselves make a puncture into the second fruit, which is called *cratitires*. These do not shew themselves till towards the end of September. The *fornites*, gradually fall away after the gnats are gone; the *cratitires* on the contrary, remain on the tree till May, and enclose the eggs deposited by the gnats when they pricked them. In May, the third sort of fruit called *orni*, begins to be produced by the wild fig-trees. This is much bigger than the other two: and when it grows to a certain size, and its bud begins to open, it is pricked in that part by the gnats of the *cratitires*, which are strong enough to go from one fruit to another to deposite their eggs. It sometimes happens that the gnats of the *cratitires* are slow to come forth in certain parts, while the *orni* in those very parts are disposed to receive them. In this case, the husbandman is obliged to look for the *cratitires* in another part, and fix them at the end of the branches of those fig-trees whose *orni* are in a fit disposition to be pricked by the gnats. If they miss the opportunity the *orni* fall, and the gnats of the *cratitires* fly away. None but those that are well acquainted with the culture know the critical moment of doing this; and in order to know it, their eye is perpetually fixed on the bud of the fig; for that part not only indicates the time that the prickers are to issue forth, but also when the fig is to be successfully pricked: if the bud is too hard and compact, the gnat cannot lay its eggs; and the fig drops when the bud is too open.

"The use of all these three sorts of fruit is to ripen the fruit of the garden fig-tree, in the following manner. During the months of June and July, the peasants take the *orni*, at the time their gnats are ready to break out, and carry them to the garden fig-trees: if they do not nick the moment, the *orni* fall; and the fruit of the domestic fig-tree, not ripening, will in a very little time fall in like manner. The peasants are so well acquainted with these precious moments, that, every morning, in making their inspection, they only transfer to their garden fig-trees such *orni* as are well conditioned, otherwise they lose their crop. In this case, however, they have one remedy, though an indifferent one; which is, to strew over the garden fig-trees another plant in whose fruit their is also a species of gnats which answer the purpose in some measure."

The caprification of the ancient Greeks and Romans, described by Theophrastus, Plutarch, Pliny, and other authors of antiquity, corresponds in every circumstance with what is practised at this day in the Archipelago and in Italy. These all agree in declaring that the wild fig-tree, *caprificus*, never ripened its fruit; but was absolutely necessary for ripening that of the garden or domestic fig, over which the husbandmen suspended its branches. The reason of this success has been supposed to be, that by the punctures of these insects the vessels of the fruit are lacerated, and thereby a greater quantity of nutritious juice derived thither. Perhaps, too, in depositing their eggs, the gnats leave behind them some sort of liquor proper to ferment gently with the milk of the figs, and to make their flesh tender. The figs in Provence, and even at Paris, ripen much sooner for having their buds pricked with a straw dipped in olive-oil. Plums and pears likewise pricked by some insects, ripen much the faster for it; and the flesh round such puncture is better tasted than the rest. It is not to be disputed, that considerable changes happen to the contexture of fruits so pricked, just the same as to parts of animals pierced with any sharp instrument. Others have supposed that these insects penetrated the fruit of the tree to which they were brought, and gave a more free admission to the air, and to the sun. Linnæus explained the operation, by supposing that the insects brought the farina from the wild fig, which contained male flowers only, to the domestic fig, which contained the female ones. Hasselquist, from what he saw in Palestine, seemed to doubt of this mode of fructification. M. Bernard, in the Memoirs of the Society of Agriculture, opposes it more decidedly. He could never find the insect in the cultivated fig; and, in reality, it appeared to leave the wild fig, after the stamina were mature and their pollen dissipated: besides, he adds, what they may have brought on their wing must be rubbed away, in the little aparture which they would form for themselves. At Malta, where there are seven or eight varieties of the domestic fig, this operation is only performed on these which ripen latest: the former are of a proper size, fine flavour, and in great abundance without it; so that he thinks the caprification only hastens the ripening. He examined the parts of fructification of the fig; and he observes, if this examination be made previous to the ripening, that round the eye of the the fig, and in the substance of its covering, may be seen triangular dentated leaves, pressed one against another; and under these leaves are the stamina, whose pollen is destined for the impregnation of the grains, which fill the rest of the fruit. These male organs are much more numerous in the wild fig than in the domestic; and the stamina are found to contain a yellow dust which may be collected when it is ripe. The wild figs, when ripe, are not succulent, and have no taste, though the grains are disposed in the same manner as in the other kind. The pith of the grain of the wild fruit serves as food to a species of the cynips, whose larva is white, till the moment of its transformation; and it is by an opening, in the direction of the pistil, that the insect penetrates the grain. From this account it is thought probable, that the insect is only communicated by accident to the domestic fig, and that the flowers of this genus are sometimes hermaphrodites. But the number of hermaphrodite flowers being fewer on the cultivated than on the wild fig, the seeds are fecundated more certainly and quickly by the caprification; and every botanist knows, that when the impregnation is completed, the flower soon withers; while if by any accident it is delayed, it continues in bloom much longer. This view of the subject, therefore,

fore, explains very completely the reason why, in Malta, the caprification is practised on the late kind of figs, because it hastens the formation and maturity of the fruit.

CAPRIMULGUS, Goat-sucker, or *Fern-owl*, in orinthology, a genus of birds belonging to the order of passeres. The beak is incurvated, small, tapering, and depressed at the base; the mouth opens very wide.

1. The Europæus, with the tubes of the nostrils hardly visible. It feeds on moths, gnats, dorrs, or chaffers; from which Charleton calls it a *dorr-hawk*, its food being entirely of that species of beetle during the month of July, the period of that insect's flight in the country. This bird migrates. It makes but a short stay in Britain: appears the latter end of May; and disappears, in the northern parts of Britain, the latter end of August; but, in the southern, stays above a month later. It inhabits all parts of Britain from Cornwall to the county of Ross. Mr Scopoli seems to credit the report of their sucking the teats of goats, an error delivered down from the days of Aristotle. Its notes are most singular. The loudest so much resembles that of a large spinning wheel, that the Welsh call this bird *aderyn y droell*, or the wheel-bird. It begins its song most punctually on the close of the day, usually sitting on a bare bough, with the head lower than the tail, the lower jaw quivering with the efforts. The noise is so very violent, as to give a sensible vibration to any little building it chances to alight on and emit this species of note. The other is a sharp squeak, which it repeats often; this seems a note of love, as it is observed to reiterate it when in pursuit of the female among the trees. It lays its eggs on the bare ground; usually two: they are of a long form, of a whitish hue, prettily marbled with reddish brown. The length of this bird is 10½ inches; extent 22. Plumage, a beautiful mixture of white, black, ash-colour, and ferruginous, disposed in lines, bars, and spots. The male is distinguished from the female by a great oval white spot near the end of the three first quill-feathers, and another on the outmost feathers of the tail. This is the only one of the genus which is found in Europe. A variety less in size, being only eight inches in length, inhabits Virginia, in summer: arrives there towards the middle of April, and frequents the mountainous parts, but will frequently approach the houses in the evening, where it settles on a rail or post, and cries for several times together very loud, somewhat like the word *whiperiwhip*, or *whip-poor-will*, the first and last syllables pronounced the loudest. After continuing in one place for some time, it flies to another, and does the same; sometimes four or five cry all together: this noise it begins just after sun-set, and continues at intervals till just before sunrise. It does not catch insects always on the wing; for it frequently sits upon a convenient place, and leaps up after them as they fly by, and returns to the same spot again. It makes no nest, but lays the eggs, which are two in number, and of a dull green with dusky spots and streaks, on the bare ground in the open fields. Kalm says that the flesh is good to eat. Another variety, larger, inhabits Virginia and Carolina; where it is called the *rain-bird*, because it never appears in the day-time, except when the sky, being obscured with clouds, betokens rain. It is said to lay the eggs on the ground, and that they are not unlike those of the Lapwing.



2. The Americanus, has the tubes of the nostrils very conspicuous. It is a night bird, and is found in America.

There are several other species or varieties inhabiting different countries, and differently marked, but all nearly similar in their manners.

CAPRIOLES, in the manege, leaps that a horse makes in the same place without advancing, in such a manner, that, when he is at the height of the leap, he jerks out with his hinder legs even and near. It is the most difficult of all the high manege. It differs from a croupade, in this, that, in a croupade, a horse does not show his shoes; and from a ballotade, because in this he does not jerk out. To make a horse work well at caprioles, he must be put between two pillars, and taught to raise first his fore-quarters, and then his hind-quarters while his fore ones are yet in the air; for which end you must give him the whip and the poinson.

CAPSA, (anc. geog.) a large and strong town of Numidia, situated amidst vast desarts, waste, uncultivated, and full of serpents, where Jugurtha kept his treasure. In his time it was taken and rased by Marius the Roman general, who put to death all the citizens capable of bearing arms, and sold the rest for slaves. It was, however, afterwards rebuilt by the Romans, and strongly fortified; but, on the decline of their empire, was taken and demolished a second time, by Occuba a famous Arab general. The walls of the citadel are still remaining, and are monuments of the ancient glory and strength of Capsa. They are 24 fathoms in height, and five in thickness, built of large square stones, and have now acquired the solidity and firmness of a rock. The walls of the town were rebuilt by the inhabitants since their first demolition; but were afterwards destroyed by Jacob Almanzar, who sent a governor and troops into the province. In Marmol's time Capsa was very populous, and abounded with stately mosques and other structures of superb and elegant workmanship: but at present it is occupied by a poor and indigent people, fleeced and oppressed by the Tunese government. In the very centre of the city stands an inclosed fountain, which both supplies the people with drink, and affords them an agreeable bath. The adjacent country is now cultivated, and produces several kinds of fruits; but the climate is unhealthy. The inhabitants are remarkable for their peevishness of temper. Both men and women dress handsomely except their feet, which they cover with coarse shoes of bungling workmanship, and made of the rough skins of wild beasts, equally inconvenient and unbecoming. E. Long. 9. 3. N. Lat. 33. 15.

CAPSARIUS, from *capsa*, satchel, in antiquity, a servant who attended the Roman youth to school, carrying a satchel with their books in it, sometimes also called librarius.

Capsarius was also an attendant at the baths, to whom persons committed the keeping of their clothes.

Capsarius, (from *capsa*, "a chest,") among the Roman bankers, was he who had the care of the money-chest or coffer.

CAPSICUM, or Guinea-pepper: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 28th order, *Luridæ*. The corolla is verticillated, and the fruit a sapless berry.

Capsicum.

*Species.* 1. The annuum, with oblong fruit, is the common long-podded capsicum commonly cultivated in the gardens. Of this there is one kind with red, and another with yellow fruit: and of these there are several varieties, differing only in the size and figure of their fruit. 2. The tetragonum, commonly called *bell-pepper*. The fruit of this is red, and is the only kind proper for pickling, the skin being tender; whereas those of the other sorts are thin and tough. The pods are from an inch to an inch and half or two inches long; are very large, swelling, and wrinkled, flatted at the top, where they are angular, and sometimes stand erect, at others grow downward. 3. The cerasiforme, with a round smooth fruit, doth not grow so tall as the other sorts, but spreads near the ground; the leaves come out in clusters, are of a shining green, and stand on long footstalks. The fruit is of a beautiful red, and of the size of a cherry. 4. The pyramidale, is a native of Egypt, and hath much narrower leaves than the other sorts. The pods always grow erect, and are produced in great plenty, so that the plants make a good appearance for three months in the winter. 5. The minimum, commonly called *bird-pepper*, rises with a shrubby stalk four or five feet high; the leaves are of a lucid green; the fruit grows at the division of the branches, standing erect: these are small, oval, and of a bright red; they are much more sharp and biting than those of the other sorts. Besides these species, botanists describe as many more; viz. the cordiforme, with heart-shaped fruit; the angulosum, with angular heart-shaped fruit; the olivaforme, with oval fruit; the conoide, commonly called *hen-pepper*, with a conical red fruit growing erect; and the fruitescens, with small pyramidal fruit growing erect; commonly called *Barbary pepper*. These, however, have no remarkable properties different from the others.

*Culture.* The three first species are annual plants, and must be propagated by seeds sown on a hot-bed in the spring, and treated in the same manner with other exotics; they will however bear the open air, after being inured to it by degrees. The plants of the second sort, whose fruit is used for pickling, should be taken from the hot-bed, and planted in a rich spot of ground in a warm situation about a foot and an half asunder. They must be shaded till they have taken root, and afterwards duly watered in dry weather, which will greatly promote their growth and cause them to be more fruitful, and likewise enlarge the size of the fruit. By this management, three or four crops of fruit for pickling may be obtained the same year. The other sorts are more tender; and therefore must be planted in pots plunged in a moderate hot-bed, and sheltered under a frame.

*Uses, &c.* The second sort, as already observed, produces fruit fit for pickling; for which purpose they must be gathered before they arrive at their full size, while their rind is tender. They must be slit down on one side to get out the seeds, after which they should be soaked two or three days in salt and water; when they are taken out of this and drained, boiling vinegar must be poured on them in a sufficient quantity to cover them, and closely stopped down for two months; then they should be boiled in the vinegar to make them green; but they want no addition of any spice, and are the wholesomest and best pickle in the world. The tenth species is used for making what is called *cayan-butter*, or *pepper-pots*, by the inhabitants of America, and which they esteem the best of all the spices. The following is a receipt for making of a pepper-pot: "Take of the ripe seeds of this sort of capsicum, and dry them well in the sun; then put them into an earthen or stone pot, mixing flour between every stratum of pods; and put them into an oven after the baking of bread, that they may be thoroughly dried: after which they must be well cleansed from the flour; and if any of the stalks remain adhering to the pods, they should be taken off, and the pods reduced to a fine powder: to every ounce of this add a pound of wheat-flour, and as much leaven as is sufficient for the quantity intended. After this has been properly mixed and wrought, it should be made into small cakes, and baked in the same manner as common cakes of the same size: then cut them into small parts, and bake them again, that they may be as dry and hard as biscuit; which being powdered and sifted, is to be kept for use." This is prodigiously hot and acrimonious, setting the mouth as it were on fire. It is by some recommended as a medicine for flatulencies; but it is greatly to be doubted whether all those hot irritating medicines are not productive of more harm than good, in England at least. If the ripe pods of capsicum are thrown into the fire, they will raise strong and noisome vapours, which occasion vehement sneezing, coughing, and often vomiting, in those who are near the place, or in the room where they are burnt. Some persons have mixed the powder of the pods with snuff, to give to others for diversion: but where it is in quantity, there may be danger in using it; for it will occasion such violent fits of sneezing, as may break the blood-vessels of the head.

Capsicum || Capstan.

CAPSQUARES, strong plates of iron which come over the trunnions of a gun, and keep it in the carriage. They are fastened by a hinge to the prize-plate, that they may lift up and down, and form a part of an arch in the middle to receive a third-part of the thickness of the trunnions: for two-thirds are let into the carriage, and the other end is fastened by two iron wedges called the *fore-locks* and *keys*.

CAPSTAN, or CAPSTERN, a strong massy column of timber, formed like a truncated cone, and having its upper extremity pierced with a number of holes to receive the bars or levers. It is let perpendicularly down through the decks of a ship; and is fixed in such a manner, that the men, by turning it horizontally with their bars, may perform any work which requires an extraordinary effort.

A capstern is composed of several parts, where A is the barrel, *b* the whelps, *c* the drum-head, and *d* the spindle. The whelps rise out from the main body of the capstern like buttresses, to enlarge the sweep, so that a greater quantity of cable, or whatever rope encircles the barrel, may be wound about it at one turn, without adding much to the weight of the capstern. The whelps reach downwards from the lower part of the drum-head to the deck. The drum-head is a broad, cylindrical piece of wood resembling a mill-stone, and fixed immediately above the barrel and whelps. On the outside of this piece are cut a number of square holes parallel to the deck to receive the bars. The spindle or pivot *d*, which is shod with iron, is the axis

Plate CXXVII.



or

or foot upon which the capstern rests, and turns round in the saucer, which is a sort of iron socket let into a wooden stock or standard called the *step*, resting upon and bolted to the beams.

Besides the different parts of the capstern above explained, it is furnished with several appurtenances, as the *bars*, the *pins*, the *pawls*, the *swifter*, and the *saucer*, already described. The bars are long pieces of wood or arms, thrust into a number of squared holes in the drum-head all round, in which they are as the radii of a circle, or the spokes in the knave of a wheel. They are used to heave the capstern round, which is done by the men setting their breasts against them, and walking about, like the machinery of a horse-mill, till the operation is finished—The pins *e*, are little bolts of iron thrust perpendicularly through the holes of the drum-head, and through a correspondent hole in the end of the bar, made to receive the pins when the bars are fixed. They are used to confine the bars, and to prevent them from working out as the men heave, or when the ship labours. Every pin is fastened to the drum-head with a small iron chain; and that the bars may exactly fit their respective holes, they are all numbered. —The pawls *f*, n° 1. are situated on each side the capstern, being two short bars of iron, bolted at one end through the deck to the beams close to the lower part of the whelps; the other end, which occasionally turns round on the deck, being placed in the intervals of the whelps, as the capstern turns round, prevents it from recoiling or turning back by any sudden jerk of the cable, as the ship rises on the sea, which might greatly endanger the men who heave. There are also hanging pawls *gg*, n° 3. used for the same purposes, reaching from the deck above to the drum-head immediately below it. The swifter is a rope passed horizontally through holes in the outer end of the bars, and drawn very tight; the intent of this is to keep the men steady as they walk round when the ship rocks, and to give room for a greater number to assist by pulling upon the swifter itself.

The most frequent use of the capstern is to heave in the cable, and thereby remove the ship or draw up the anchor. It is also used to wind up any weighty body, as the masts, artillery, &c. In merchant-ships it is likewise frequently employed to discharge or take in the cargo, particularly when consisting of weighty materials that require a great exertion of mechanical powers to be removed.

There are commonly two capsterns in a man of war, the *main* and the *gear* capstern; the former of which has two drum-heads, and may be called a *double one*. This is represented in n° 3. The latter is represented in n° 2.

Formerly the bars of the capstern went entirely thro' the head of it, and consequently were more than double the length of the present ones; the holes were therefore formed at different heights, as represented in n° 1. But this machine had several inconveniences, and has long been entirely disused in the navy. Some of these sort of capsterns, however, are still retained in merchant-ships, and are usually denominated *crabs*. The situation of the bars in a crab, as ready for heaving, is represented in n° 4.

*To Rig the* Capstern, is to fix the bars in their respective holes, and thrust in the pins, in order to confine them.—*Surge the* Capstern, is the order to slacken the rope heaved round upon it, of which there are generally two turns and a half about the barrel at once, and sometimes three turns.—*To Heave the* Capstern, is to go round with it heaving on the bars, and drawing in any rope of which the purchase is created.—*To Come-up the* Capstern, is to let go the rope upon which they have been heaving.—*To Pawl the* Capstern, is to fix the pawls to prevent it from recoiling during any pause of heaving.



CAPSULE, in a general sense, denotes a receptacle or cover in form of a bag.

Capsule, among botanists, a dry hollow seed-vessel or pericarpium, that cleaves or splits in some determinate manner. See Pericarpium.

This species of seed vessel is frequently fleshy and succulent, like a berry, before it has attained maturity; but, in ripening, becomes dry, and often so elastic as to dart the seeds from their departments with considerable velocity. This elasticity is remarkably conspicuous in wood-sorrel; balsam, *impatiens*; African spiræa, *diosma*; *fraxinella*; *justicia*; *ruellia*; *barleria*; *lathræa*; and many others.—The general aptitude or disposition of this species of seed-vessel to cleave or separate for the purpose of dispersing its seeds, distinguishes it not less remarkably than its texture from the pulpy or succulent fruits of the apple, berry, and cherry kind. This opening of the capsule for discharging its seeds when the fruit is ripe, is either at the top, as in most plants; at the bottom, as in triglochin; at the side through a pore or small hole, as in campanula and orchis; horizontally, as in plantain, amaranthus, and anagallis; or longitudinally, as in convolvulus. All fruit that is jointed opens at every one of the joints, each of which contains a single seed. Capsules, in splitting, are divided, externally, into one or more pieces, called by Linnæus *valves*. The internal divisions of the capsules are called *cells*, *locumenta*: these, in point of number, are exceedingly diversified; some having only one cell, as the primrose; and others many, as the water-lily. Hence a capsule is termed *unilocular*, *bilocular*, *trilocular*, &c. according as it has one, two, three, &c. cells or cavities.

*Capsulæ Atrabiliariæ*, called also *glandulæ renales*, and *renes succenturiati*. See Anatomy, n° 100.

CAPTAIN, a military officer, whereof there are several kinds, according to their commands.

*Captain of a Troop or Company*, an inferior officer who commands a troop of horse or a company of foot, under a colonel. The duty of this officer is to be careful to keep his company full of able bodied soldiers; to visit their tents and lodgings, to see what is wanting; to pay them well; to cause them keep themselves neat and clean in their clothes, and their arms bright. He has power in his own company of making serjeants, corporals, and lanspesades.

In the horse and foot guards, the captains have the rank of colonels.

*Captain-General*, he who commands in chief.

*Captain-Lieutenant*, he who with the rank of captain, but the pay of lieutenant, commands a troop or company in the name and place of some other person who is dispensed with on account of his quality from performing the functions of his post.

Thus the colonel being usually captain of the first company

company in his regiment, that company is commanded by his deputy under the title of *captain-lieutenant*.

So in England, as well as in France, the king, queen, dauphin, princes, &c. have usually the title of captain of the guards, *gens d'armes*, &c. the real duty of which offices is performed by captain-lieutenants.

*Captain Reformed*, one who, upon the reduction of the forces, has his commission and company suppressed; yet is continued captain, either as second to another, or without any post or command at all.

*Captain of a Ship of War*, the officer who commands a ship of the line of battle, or a frigate carrying 20 or more cannon. The charge of a captain in the British navy is very comprehensive, in as much as he is not only answerable for any bad conduct in the military government, navigation, and equipment of the ship he commands, but also for any neglect of duty or ill management in his inferior officers, whose several charges he is appointed to superintend and regulate.

On his first receiving information of the condition and quality of the ship he is appointed to command, he must attend her constantly, and hasten the necessary preparations to fit her for sea. So strict, indeed, are the injunctions laid on him by the lord high admiral, or commissioners of the admiralty, that he is forbid to lie out of his ship, from his arrival on board to the day of his discharge, unless by particular leave from the admiralty, or from his commander in chief. He is enjoined to shew a laudable example of honour and virtue to the officers and men; and to discountenance all dissolute, immoral, and disorderly practices, and such as are contrary to the rules of subordination and discipline; as well as to correct those who are guilty of such offences as are punishable according to the usage of the sea. He is ordered particularly to survey all the military stores which are sent on board, and to return whatever is deemed unfit for service. His diligence and application are required to procure his complement of men; observing carefully to enter only such as are fit for the necessary duty, that the government may not be put to unnecessary expence. When his ship is fully manned, he is expected to keep the established number of men complete, and superintend the muster himself if there is no clerk of the check at the port. When his ship is employed on a cruising station, he is expected to keep the sea the whole length of time previously appointed; but if he is compelled by some unexpected accident to return to port sooner than the time limited, he ought to be very cautious in the choice of a good situation for anchoring, ordering the master or other careful officer to sound and discover the depths of water and dangers of the coast. Previous to any possibility of an engagement with the enemy, he is to quarter the officers and men to the necessary stations according to their office and abilities, and to exercise them in the management of the artillery, that they may be more expert in time of battle. His station in the time of an engagement is on the quarter-deck: at which time he is expected to take all opportunities of annoying his enemy, and improving every advantage over him; to exhibit an example of courage and fortitude to his officers and crew; and to place his ship opposite to his adversary in such a position as that every cannon shall do effectual execution. At the time of his arrival in port, after his return from abroad, he is to assemble his officers, and draw up a detail of the observations that have been made during the voyage, of the qualities of the ship as to her trim, ballast, stowage, manner of sailing, for the information and direction of those who may succeed him in the command: and this account is to be signed by himself and officers, and to be returned to the resident commissioner of the navy at the port where the ship is discharged.



*Captain of a Merchant-ship*, he who has the direction of the ship, her crew, and lading, &c. In small ships and short voyages, he is more ordinarily called the *master*. In the Mediterranean, he is called the *patroon*.—The proprietor of the vessel appoints the captain or master; and he is to form the crew, and choose and hire the pilots, mates, and seamen; though, when the proprietor and master reside on the same spot, they generally act in concert together.

*Captain Bashaw*, or *Capondan Bashaw*, in the polity of the Turks, signifies the Turkish high admiral. He possesses the third office of the empire, and is invested with the same power at sea that the vizir has on shore. Soliman II. instituted this office in favour of the famous Barbarossa, with absolute authority over the officers of the marine and arsenal, whom he may punish, cashier, or put to death, as soon as he is without the Dardanelles. He commands in chief in all the maritime countries, cities, castles, &c. and, at Constantinople, is the first magistrate of police in the villages on the side of the port, and the canal of the Black-Sea. The mark of his authority is a large Indian cane, which he carries in his hand, both in the arsenal and with the army.—The captain-bashaw enjoys two sorts of revenues; the one fixed, the other casual. The first arise from a capitation of the islands in the Archipelago, and certain governments in Natolia and Galipoli. The latter consist in the pay of the men who die during a campaign; in a fifth of all prizes made by the begs; in the profits accruing from the labour of the slaves, whom he hires as rowers to the grand signior; and in the contributions he exacts in all places where he passes.

CAPTION, in Scots law, a writ issuing under his majesty's signet, in his majesty's name, obtained at the instance of a creditor in civil debt, commanding messengers at arms and other officers of the law to apprehend and imprison the person of the debtor until he pay the debt.—It is also the name of a writ issued by the court of Session against the agents of the court, to return papers belonging to processes or law-suits, or otherwise to go to prison.

CAPTIVE, a slave, or a person taken from the enemy.

Formerly captives in war became the slaves of those who took them; and though slavery, such as obtained among the ancients, is now abolished, some shadow of it still remains in respect of prisoners of war, who are accounted the property of their captors, and have no right to liberty but by concession from them.—The Romans used their captives with great severity; their necks were exposed to the soldiers to be trampled on, and their persons afterwards sold by public auction. Captives were frequently burnt on the funeral piles of the ancient warriors, as a sacrifice to the infernal

Captivity ‖ Capua.

fernal gods. Those of royal or noble blood had their heads shaven, and their hair sent to Rome to serve as decorations for female toys, &c. They were led in triumph loaded with chains through Rome, in the emperor's train, at least as far as the foot of the Capitoline mount, for they were not permitted to ascend the sacred hill, but carried thence to prison. Those of the prime quality were honoured with golden chains on their hands and feet, and golden collars on their necks. If they made their escape, or killed themselves, to avoid the ignominy of being carried in triumph, their images or effigies were frequently carried in their place.

CAPTIVITY, in a general sense, the state or condition of a captive.

CAPTIVITY, in sacred history, a punishment which God inflicted upon his people for their vices and infidelities. The first of these captivities is that of Egypt, from which Moses delivered them; after which, are reckoned six during the government of the judges; but the greatest and most remarkable were those of Judah and Israel, which happened under the kings of each of these kingdoms. It is generally believed, that the ten tribes of Israel never came back again after their dispersion; and Josephus and St Jerom are of this opinion: nevertheless, when we examine the writings of the prophets, we find the return of Israel from captivity pointed out in a manner almost as clear as that of the tribes of Benjamin and Judah: See Hosea i. 10, 11. Amos ix. 14. The captivities of Judah are generally reckoned four; the fourth and last of which fell in the year of the world 3416, under Zedekiah: and from this period begins the 70 years captivity foretold by Jeremiah.

Since the destruction of the temple by the Romans, the Hebrews boast that they have always had their heads or particular princes, whom they call *princes of the captivity*, in the east and west. The princes of the captivity in the east governed the Jews that dwelt in Babylon, Assyria, and Persia; and the princes of the captivity in the west governed those who dwelt in Judæa, Egypt, Italy, and in other parts of the Roman empire. He who resided in Judæa commonly took up his abode at Tiberias, and assumed the name of *Roschabboth*, "head of the fathers or patriarchs." He presided in assemblies, decided in cases of conscience, levied taxes for the expences of his visits, and had officers under him who were dispatched through the provinces for the execution of his orders. As to the princes of the captivity at Babylon, or the east, we know neither the original nor succession of them. It only appears that they were not in being before the end of the second century.

CAPTURE, a prize, or prey; particularly that of a ship taken at sea. Captures made at sea were formerly held to be the property of the captors after a possession of twenty-four hours; but the modern authorities require, that before the property can be changed, the goods must have been brought into port, and have continued a night *intra præsidia*, in a place of safe custody, so that all hope of recovering them was lost.

CAPTURE also denotes an arrest or seizure of a criminal, debtor, &c. at land.

CAPUA, (anc. geog.) a very ancient city of Italy, in Campania, and capital of that district. It is famous for the abode of Hannibal the Carthaginian general after the battle of Cannæ, and where Livy accuses him, but unjustly, of having enervated himself with pleasures*. It still retains the name, and is the see of an archbishop. It is seated on the river Vulturno, in E. Long 15. 5. N. Lat. 41. 7. The history of Capua is thus shortly deduced by Mr Swinburne. "It was a settlement of the Osci known before the foundation of Rome; as the amazing fertility of the land and a lucrative commerce poured immense wealth upon its inhabitants, it became one of the most extensive and magnificent cities in the world. With riches excessive luxury crept in, and the Capuans grew insolent; but by their effeminacy they soon lost the power of repelling those neighbouring nations which their insolence had exasperated: For this reason Capua was continually exposed to the necessity of calling in foreign aid, and endangering its safety by the uncommon temptations it offered to needy auxiliaries. The Roman soldiers sent to defend Capua were on the point of making it their prey, and often the voice of the Roman people was loud for a removal from the barren unwholesome banks of the Tiber to the garden of Italy, near those of the Vulturno. Through well-founded jealousy of the ambition of Rome, or, as Livy and other partial writers term it, natural inconstancy, the Capuans warmly espoused the quarrel of Carthage: Hannibal made Capua his winter-quarters after the campaign of Cannæ; and there, if we are to believe historians, his rough and hitherto invincible soldiers were enervated by pleasure and indolence.

* See *Carthage*.

"When through a failure of supplies from Carthage Hannibal was under a necessity of remaining in Brutium, and leaving the Capuans to defend themselves, this city, which had been long invested, was surrendered at discretion to the consuls Appius Claudius and Q. Fulvius Flaccus. The senators were put to death, the nobles imprisoned for life, and all the citizens sold and dispersed. Vibius, the chief of Hannibal's friends, avoided this ignominous fate, and escaped from the cruel vengeance of the Romans by a voluntary death. —When the mob insisted upon the gates being thrown open to the enemy, Vibius assembled his steady associates, and sat down with them to a superb banquet, after which each of the guests swallowed a poisonous draught, and expired in full possession of their freedom. The buildings were spared by the victor; and Capua was left to be merely a harbour for the husbandmen of the plain, a warehouse for goods, and a granary for corn; but so advantageous a situation could not long be neglected; colonies were sent to inhabit it, and in process of time it regained a degree of importance.

"Genseric the Vandal was more cruel than the Roman conquerors had been; for he massacred the inhabitants, and burnt the town to the ground. Narses rebuilt it; but in 841 it was totally destroyed by an army of Saracens, and the inhabitants driven into the mountains. Some time after the retreat of these savage invaders, the Lombards ventured down again into the plain, but not deeming their force adequate to the defence of so large a circuit as the old city, they built themselves a smaller one on the river, and called it Capua.—They chose the site of Casilinum, famous in the second Punic war for the resistance made by its garrison against Hannibal. Since the foundation of the new city, old Capua has remained in ruins.

"In 856 Landulph formed here an independent earldom dismembered from the duchy of Benevento, and in the course of a few generations Capua acquired the title of a principality. In the 11th century, the Normans of Aversa expelled the Lombard race of princes, and Richard their chief became prince of Capua; the grandson of Tancred of Hauteville drove out the descendants of Richard, and united this state to the rest of his possessions.

"Capua is at present a neat little city, fortified according to the rules of modern art, and may be considered as the key of the kingdom: though far removed from the frontier, it is the only fortification that really covers the approach to Naples."

CAPUCHINS, religious of the order of St Francis in its strictest observance; deriving their name from *capuce*, or *capuchon*, a stuff cap, or cowl, wherewith they cover their heads. They are clothed with brown or grey; always bare-footed; are never to go in a coach, nor ever shave their beard.—The capuchins are a reform made from the order of minors, commonly called *cordeliers*, set on foot in the 16th century by Matthew Baschi, a religious observant of the monastery of Montefiascone; who, being at Rome, was advertised several times from heaven, to practise the rule of St Francis to the letter. Upon this he made application to pope Clement in 1525; who gave him permission to retire into a solitude, with as many others as chose to embrace the strict observance. In 1528, they obtained the pope's bull. In 1529, the order was brought into complete form; Matthew was elected general, and the chapter made constitutions. In 1543, the right of preaching was taken from the capuchins by the pope: but in 1545 it was restored to them again with honour. In 1578, there were already 17 general chapters in the order of capuchins.

CAPUT, the head. See HEAD.

CAPUT *baroniæ*, the head of the barony, in ancient customs, denotes the ancient or chief seat or castle of a nobleman, where he made his usual residence, and held his court; sometimes also called *caput honoris*, or the head of the honour. The Caput baroniæ could not be settled in dowry; nor could it be divided among the daughters, in case there were no son to inherit; but was to descend entire to the eldest daughter, *cæteris filiabus aliunde satisfactis*.

CAPUT *gallinaginis*, in anatomy, is a kind of septum, or spongious border, at the extremities or apertures of each of the *vesiculæ seminales*; serving to prevent the seed coming from one side, from rushing upon, and so stopping, the discharge of the other.

CAPUT *lupinum*. Anciently an outlawed felon was said to have *caput lupinum*, and might be knocked on the head like a *wolf*, by any one that should meet him; because, having renounced all law, he was to be dealt with as in a state of nature, when every one that should find him might slay him: yet now, to avoid such inhumanity, it is holden that no man is intitled to kill him wantonly and wilfully; but in so doing he is guilty of murder, unless it is done in the endeavour to apprehend him.



CAPUT *Mortuum*, a Latin name given to fixed and exhausted residuums remaining in retorts after distillations. As these residuums are very different, according to the substances distilled, and the degree of heat employed, they are by the more accurate modern chemists particularly specified by adding a term denoting their qualities; as *earthy residuum, charry residuum, saline residuum*, &c.

CARABINE, a fire-arm shorter than a musket, carrying a ball of 24 in the pound, borne by the light horse, hanging at a belt over the left shoulder. The barrel is two feet and an half long; and is sometimes furrowed spirally within, which is said to add to the range of the piece.

CARABINEERS, regiments of light horse, carrying longer carabines than the rest, and sometimes used on foot.

CARABUS, in zoology, a genus of insects belonging to the order of coleoptera, or the beetle kind. The feelers are bristly; the breast is shaped like a heart, and marginated; and the elytra are likewise marginated. There are 34 species of this genus, mostly distinguished by their colour. The most remarkable is the crepitans, or bombardier, with the breast, head, and legs, ferruginous or iron-coloured, and the elytra black. It keeps itself concealed among stones, and seems to make little use of its wings: when it moves, it is by a sort of jump; and whenever it is touched, one is surprised to hear a noise resembling the discharge of a musket, in miniature, during which a blue smoke may be perceived to proceed from its anus. The insect may be made at any time to play off its artillery, by scratching its back with a needle. If we may believe Rolander, who first made these observations, it can give 20 discharges successively. A bladder placed near the anus is the arsenal whence it derives its store, and this is its chief defence against an enemy, although the smoke emitted seems to be altogether inoffensive, except it be by causing a fright, or concealing its course. Its chief enemy is another species of the same genus, but four times larger: when pursued and fatigued, the bombardier has recourse to this stratagem, by lying down in the path of the large carabus, which advances with open mouth and claws to seize it; but, on this discharge of the artillery, suddenly draws back, and remains a while confused: during which the bombardier conceals himself in some neighbouring crevice; and if not happy enough to find one, the large carabus returns to the attack, takes the insect by the head, and tears it off.

Plate CXXV.

CARACALLA, (M. Antoninus Bassianus), emperor after his father Severus in 211, put the physicians to death for not dispatching his father as he would have had them. He killed his brother Geta; and put Papinianus to death, because he would not defend nor excuse his parricide. In short, it is said that 20,000 persons were massacred by his order. He married Julia, his father's widow. Going to Alexandria, he slew the inhabitants, and applied to the magicians and astrologers. At last, going from Edessa to Mesopotamia, one of his captains slew him, by order of Macrinus, who succeeded him. He died after he had reigned somewhat more than six years.

CARACALLA, in antiquity, a long garment, having a sort of capuchin, or hood a-top, and reaching to the heels; worn equally among the Romans by the men and

and the women, in the city and the camp. Spartian and Xiphilian represent the emperor Caracalla as the inventor of this garment, and hence suppose the appellation *Caracalla* was first given him. Others, with more probability, make the caracalla originally a Gallic habit, and only brought to Rome by the emperor abovementioned, who first enjoined the soldiery to wear it. The people called it *antoninian*, from the same prince, who had borrowed the name of Antoninus. The caracalla was a sort of cassock, or surtout. Salmasius, Scaliger, and after them Du-Cange, even take the name *casaque* to have been formed from that of *caraque*, for *caracalla*. This is certain from St Jerom, that the caracalla, with a retrenchment of the capuchin, became an ecclesiastical garment. It is described as made of several pieces cut and sewed together, and hanging down to the feet; but it is more than probable there were some made shorter, especially out of Rome, otherwise we do not see how it could have fitted the soldiers purposes.

CARACCAS, a district of Terra Firma in South America, belonging to the Spaniards. The coast is rocky and mountainous, interspersed with small fertile valleys; subjected at certain seasons of the year to dry north-west winds, but blessed in general with a clear air and wholesome climate. A very great illicit trade is carried on by the English and Dutch with this province, notwithstanding all the vigilance of the Spaniards, who have scouts perpetually employed, and breast-works raised in all the valleys. A vast number of cacao-trees are cultivated in this province; and it is reckoned that the crop of cacao produced here amounts to more than 100,000 fanegas of 110 pounds each. The country of Santa Fe consumes 20,000; Mexico a little more; the Canaries a small cargo; and Europe from 50 to 60,000. The cultivation of the plant employs 10 or 12,000 negroes. Such of them as have obtained their liberty have built a little town called *Nirva*, into which they will not admit any white people. The chief town is likewise called *Caraccas*, and is situated in N. Lat. 10. 10. Dampier says it stands at a considerable distance from the sea; is large, wealthy, and populous; and extremely difficult of access, by reason of the steep and craggy hills over which an enemy must take his route. The commerce of this town, to which the bay of Guaira at two leagues distance serves for a harbour, was for a long time open to all the subjects of the Spanish monarchy, and is still so to the Americans; but the Europeans are not so well treated. In 1728 a company was formed at St Sebastian, which obtained an exclusive right of maintaining connections with this part of the new world. Four or five ships, which they dispatch every year, sail from thence, but they return to Cadiz.

CARACCI, (Lewis, Augustin, and Hannibal), three celebrated painters of the Lombard school, all of Bologna. Lewis was born in 1555; and was cousin-german to Augustin and Hannibal who were brothers, the sons of a taylor, who was yet careful to give them a liberal education. They were both disciples of their cousin Lewis. Augustin gained a knowledge of mathematics, natural philosophy, music, poetry, and most of the liberal arts; but, though painting was his principal pursuit, he learned the art of engraving from Cornelius Cort, and surpassed all the masters of his time. Hannibal, again, never deviated from his pencil. —These three painters, at length, having reaped all the advantages they could by contemplation and practice, formed a plan of association, continued always together, and laid the foundation of that celebrated school which has ever since been known by the name of *Caracci's academy*. Hither all the young students, who had a view of becoming masters, resorted to be instructed in the rudiments of painting; and here the Caracci taught freely, and without reserve, all that came. Lewis's charge was to make a collection of antique statues and bas-reliefs. They had designs of the best masters, and a collection of curious books on all subjects relating to their art; and they had a skilful anatomist always ready to teach what belonged to the knitting and motions of the muscles, *&c.* There were often disputations in the academy; and not only painters, but men of learned professions, proposed questions, which were always decided by Lewis. Every body was well received; and though stated hours were allotted to treat of different matters, yet improvements might be made at all hours by the antiquities and the designs which were to be seen.

The fame of the Caracci reaching Rome, the cardinal Farnese sent for Hannibal thither, to paint the gallery of his palace. Hannibal was the more willing to go, because he had a great desire to see Raphael's works, with the antique statues and bas-reliefs. The gusto which he took there from the ancient sculpture, made him change his Bolognian manner for one more learned but less natural in the design and in the colouring. Augustin followed Hannibal, to assist him in his undertaking of the Farnese gallery; but the brothers not rightly agreeing, Farnese sent Augustin to the court of the duke of Parma, where he died in the year 1602, being only 45 years of age. His most celebrated piece of painting is that of the communion of St Jerom, in Bologna.

In the mean while, Hannibal continued working in the Farnese gallery at Rome; and, after inconceivable pains and care, finished the paintings in the perfection in which they are now to be seen. He hoped that the cardinal would have rewarded him in some proportion to the excellence of his work, and the time it took him up, which was eight years; but he was disappointed. The cardinal, influenced by an ignorant Spaniard his domestic, gave him but a little above 200l. though it is certain he deserved more than twice as many thousands. When the money was brought him, he was so surprised at the injustice done him that he could not speak a word to the person who brought it. This confirmed him in a melancholy to which his temper naturally inclined, and made him resolve never more to touch his pencil; which resolution he had undoubtedly kept, if his necessities had not compelled him to break it. It is said that his melancholy gained so much upon him, that at certain times it deprived him of the use of his senses. It did not, however, put a stop to his amours; and his debauches at Naples, whither he had retired for the recovery of his health, brought a distemper upon him of which he died in 1609, when he was 49 years of age. His veneration for Raphael was so great, that it was his deathbed request to be buried in the same tomb with him; which was accordingly done, in the pantheon or rotunda at Rome. There are extant several

veral prints of the bleſſed Virgin, and ſome other ſubjects etched by the hand of this incomparable artiſt. He is ſaid to have been a friendly, plain, honeſt, and open-hearted man: very communicative to his ſcholars: and ſo extremely kind to them, that he generally kept his money in the ſame box with his colours, where they might have recourſe to either as they had occaſion.

While Hannibal Caracci worked at Rome, Lewis was courted from all parts of Lombardy, eſpecially by the clergy, to make pictures in their churches; and we may judge of his capacity and facility, by the great number of pictures he made, and by the preference that was given him to other painters. In the midſt of theſe employments Hannibal ſolicited him to come and aſſiſt him in the Farneſe gallery: and ſo earneſtly, that he could not avoid complying with his requeſt. He went to Rome; corrected ſeveral things in that gallery; painted a figure or two himſelf; and then returned to Bologna, where he died in 1619, aged 64.

CARACOL, in the manege, the half turn which an horſeman makes, either to the right or left—In the army, the horſe always makes a caracol after each diſcharge, in order to paſs the rear of the ſquadron.

Caracol, in architecture, denotes a ſtair-caſe in a helix or ſpiral form.

CARACOLI, a kind of metal of which the Caribbees, or natives of the Leſſer Antilles, make a ſort of ornament in the form of a creſcent, which they alſo call *caracoli.*—This metal comes from the main land: and the common opinion is, that it is a compound of ſilver, copper, and gold, ſomething like the Corinthian braſs among the ancients. Theſe metals are ſo perfectly mixed and incorporated together, that the compound which reſults from them, it is ſaid, has a colour that never alters, how long ſoever it remains in the ſea or under ground. It is ſomewhat brittle; and they who work at it are obliged to mix a large proportion of gold with it, to make the compound more tough and malleable.

CARACT, or Carat, the name of that weight which expreſſes the degree of fineneſs that gold is of. The word is alſo written, *carract, carrat, karract*, and *karrat*. Its origin is conteſted: But the moſt probable opinion is that of Kennet, who derives it from *caretta*, a term which anciently denoted any weight, and came not till of later days to to be appropriated to that which expreſſes the fineneſs of gold and the gravity of diamonds.

Theſe carats are not real determinate weights, but only imaginary. The whole maſs, be the weight what it will, is conceived to be divided into 24 carats; and as many 24th parts as it contains of pure gold, it is called *gold of ſo many carats*, or *ſo many carats fine*. Thus, gold of 18 carats is a mixt, of which 18 parts is pure gold, and the other ſix an inferior metal, &c. This is the common way of reckoning in Europe, and at the gold mines in the Spaniſh Weſt Indies, but with ſome variation in the ſubdiviſion of the carat: among us, it is divided into four grains; among the Germans, into 12 parts; and by the French, according to Mr Helot, into 32. The Chineſe reckon by a different diviſion called *touches*, of which the higheſt number, or that which denotes pure gold, is 100; ſo that 100 touches correſpond to our 24 carats, &c.

Caract is alſo a certain weight which goldſmiths and jewellers uſe wherewith to weigh precious ſtones and pearls.—In this ſenſe, the word is by ſome ſuppoſed to be derived from the Greek κεράτιον, a fruit which the Latins call *ſiliqua*, and we *carob bean*; each of which may weigh about four grains of wheat, whence the Latin *ſiliqua* has been uſed for a weight of four grains. This caract weighs four grains, but they are ſomething lighter than the grains of other weights. Each of theſe grains is ſubdivided in $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, &c.

CARACTACUS, a renowned king of the ancient Britiſh people called *Silures*, inhabiting South Wales. Having valiantly defended his country ſeven years againſt the Romans, he was at length defeated; and flying to Cartiſmunda, queen of the Brigantes (inhabitants of Yorkſhire), was by her treacherouſly delivered up to the Romans, and led in triumph to the emperor Claudius then at York; where his noble behaviour, and heroic but pathetic ſpeech, obtained him not only his liberty, but the eſteem of the emperor, A. D. 52.

CARAGROUTH, in commerce, a ſilver coin of the empire, weighing nine drachms. It goes at Conſtantinople for 120 aſpers. There are four ſorts of them, which are all equally current and of the ſame value.

CARAITES, in the eccleſiaſtical hiſtory of the Jews, a religious ſect among that people, whereof there are ſtill ſome ſubſiſting in Poland, Ruſſia, Conſtantinople, Cairo, and other places of the Levant, whoſe diſtinguiſhing tenet and practice it is, to adhere cloſely to the words and letter of the ſcripture, excluſive of allegories, traditions, and the like.

Leo of Modena, rabbin of Venice, obſerves, that of all the hereſies among that people, before the deſtruction of the temple, there is none now left but that of the *Caraim*, a name derived from *Micra*, which ſignifies the pure text of the Bible; becauſe of their keeping to the Pentateuch, obſerving it to the letter, and rejecting all interpretations, paraphraſes, and conſtitutions of the rabbins. Aben Ezra, and ſome other rabbins, treat the Caraites as Sadducees; but Leo de Juda calls them, more accurately, Sadducees reformed; becauſe they believe the immortality of the ſoul, paradiſe, hell, reſurrection, &c. which the ancient Sadducees denied. He adds, however, that they were doubtleſs originally real Sadducees, and ſprung from among them.

M. Simon, with more probability, ſuppoſes them to have riſen hence; that the more knowing among the Jews oppoſing the dreams and reveries of the rabbins, and uſing the pure texts of ſcripture to refute their groundleſs traditions, had the name of *Caraim* given them; which ſignifies as much as the barbarous Latin, *Scripturarii*; i. e. people attached to the text of ſcripture. The other Jews give them the odious name Sadducees, from their agreement with thoſe ſectaries on the head of traditions. Scaliger, Voſſius, and Spanheim, rank the Caraites among the Sabeans, Magi, Manichees, and Muſſulmans, but by miſtake: Wolfgang, Fabricius, &c. ſay the Sadducees and Eſſeni were called Caraites, in oppoſition to the Phariſees: others take them for the doctors of the law ſo often mentioned in the goſpel; but theſe are all conjectures. Joſephus and Philo make no mention of them; which ſhows

shows them to be more modern than either of those authors. In all probability, this sect was not formed till after the collection of the second part of the Talmud, or the Gemara; perhaps not till after the compiling of the Mischna in the third century. The Caraites themselves pretend to be the remains of the ten tribes led captive by Shalmanefer. Wolfius, from the Memoirs of Mardacheus, a Caraite, refers their origin to a massacre among the Jewish doctors, under Alexander Jannæus, their king, about 100 years before Christ: because Simeon, son of Schetach, and the queen's brother, making his escape into Egypt, there forged his pretended traditions; and, at his return to Jerusalem, published his visions; interpolating the law after his own fancy, and supporting his novelties on the notices which God, he said, had communicated by the mouth of Moses, whose depositary he was: he gained many followers; and was opposed by others, who maintained, that all which God had revealed to Moses was written. Hence the Jews became divided into two sects, the Caraites and Traditionaries: among the first, Juda, son of Tabbai, distinguished himself; among the latter, Hillel. Wolfius, reckons not only the Sadducees, but also the Scribes, in the number of Caraites. But the address of the Pharisees prevailed against them all; and the number of Caraites decreased: Anan, indeed, in the eighth century, retrieved their credit a little; and rabbi Schalomon in the ninth. They succeeded pretty well till the fourteenth; but since that time they have been declining.

The Caraites are but little known; their works coming only into very few hands, even among the greatest Hebraists. Buxtorf never saw more than one; Selden two; but Mr Trigland says, he has recovered enough to speak of them with assurance. He asserts, that soon after the prophets had ceased, the Jews became divided on the subject of works, and supererogation: some maintaining their necessity from tradition; whilst others keeping close to the written law, set them aside; and it was from these last that Caraitism commenced. He adds, that after the return from the Babylonish captivity, the observation of the law being to be re-established, there were several practices found proper for that end; and these once introduced, were looked upon as essential, and appointed by Moses; which was the origin of Pharisaism; as a contrary party, continuing to keep close to the letter, founded Caraitism.

The modern Caraites, Leo of Modena observes, have their synagogues and ceremonies; they pretend to be the sole proper Jews, or observers of the laws of Moses; calling the rest by the term *Rabbanim*, or *followers of the Rabbins*: these hate the Caraites mortally; refusing to ally or even converse with them, and treating them as *mamzerim*, or bastards; because of their rejecting the constitutions of the rabbins relating to marriages, repudiations, purifications of women, &c. This aversion is so great, that if a Caraite would become a rabbinist, he would never be received by the other Jews.

The Caraites, however, do not absolutely reject all kind of traditions; but only such as do not appear well-grounded. Selden, who is very express on this point, in his Uxor Hebraica, observes, that besides the mere text, they have certain interpretations, which they call hereditary, and which are proper traditions. Their theology only seems to differ from that of the other Jews, in that it is purer, and clearer of superstition: they give no credit to the explications of the Cabbalists, chimerical allegories, nor to any constitutions of the Talmud, but what are conformable to the scripture, and may be drawn from it by just and necessary consequences.



Peringer observes of the Caraites in Lithuania, that they are very different, both in aspect, language, and manners, from the rabbinists, wherewith that country abounds. Their mother tongue is the Turkish; and this they use in their schools and synagogues. In visage they resemble the Mahometan Tartars. Their synagogues are placed north and south; and the reason they give for it is, that Shalmanefer brought them northward: so that in praying, to look to Jerusalem, they must turn to the south. He adds, that they admit all the books of the Old Testament; contrary to the opinion of many of the learned, who hold that they reject all but the Pentateuch.

Caleb, a Caraite, reduces the difference between them and the rabbinists to three points: 1. In that they deny the oral law to come from Moses, and reject the Cabbala. 2. In that they abhor the Talmud. 3. In that they observe the feasts, as the sabbaths, &c. much more rigorously than the rabbins do. To this may be added, that they extend the degrees of affinity, wherein marriage is prohibited, almost to infinity.

CARAMANIA, a considerable province of Turkey, in Asia, in the south part of Natolia. Bajazet united this province to his empire about the year 1488, and since that time it has continued in the possession of the Turks. Satalia was the capital city, but is now much decayed.

CARAMANTA, a town of South America, and capital of a province of the same name in Terra Firma, and in the audience of Santa Fe. W. Long. 72. 35. N. Lat. 5. 18. The province of Caramanta is extended on both sides the river Cauca; and is bounded on the north by the district of Carthagena, on the east by New Grenada, on the south by Popayan, and on the west by Popayan and by the audience of Panama. It is a valley surrounded on every side by very high mountains.

CARANGA, an inconsiderable island near Bombay in the East Indies. It affords nothing but some rice, fowls, and goats, for that market.

CARANNA, or KARANNA, a very scarce gum which comes from New Spain. It is said to possess many extraordinary medical virtues, but the present practice takes no notice of it.

CARANUS, the first king of Macedon, and the seventh of the race of the Heraclides. See MACEDONIA.

CARARA, a weight at Leghorn, and in other parts of Italy, used in the sale of wool and cod-fish, equivalent to 60 pounds of that country.

CARAT. See CARACT.

CARAVAGGIO, (Michael Angelo da). See ANGELO.

CARAVAN, or KARAVANNE, in the east, signifies a company or assembly of travellers and pilgrims, and more particularly of merchants, who, for their greater security, and in order to assist each other, march in a body through the deserts, and other dangerous places, which are infested with Arabs or robbers.

There

There are four regular caravans which go yearly to Mecca; the first from Damascus, composed of the pilgrims from Europe and Asia; the second from Cairo, for the Mahometans of Barbary; the third from Zibith, a place near the mouth of the Red Sea, where those of Arabia and India meet; the fourth from Babylon, where the Persians assemble. Most of the inland commerce of the East is carried on by caravans. The late czar Peter the Great established a trade between Russia and China by means of a caravan. M. Bougnon, geographer to the duke of Lorrain, has given a treatise of the caravans of merchants in Asia; wherein he shows of what they are composed, how many sorts there are, the several uses of the different sorts of animals in them; the prices given for them, the officers and men appointed to conduct them, and the pay of each, with their manner of marching, halting, fighting retreating, &c. Caravans of this kind are large convoys of armed men, merchants, and travellers, with divers sorts of animals for the carriage of their provisions. There are commonly four chief officers of a caravan, viz. the caravan bachi, or chief; the captain-guide; captain of rest; and captain of distribution. The first has absolute command over all the rest: the second is absolute in the march: the office of the third only commences when the caravan stops and makes a stay: to the fourth it belongs to dispose of every part of the corps, in case of an attack or battle; he has also the inspection over the distribution of provisions, which is made under him by several distributors, who give security to the master of the caravan, and have each of them a certain number of persons, elephants, dromedaries, &c. to take care of at their own peril. The treasurer of the caravan makes a fifth officer, who has under him several agents and interpreters, who keep journals of all that passes, for the satisfaction of those concerned in fitting out the caravan.

Any dealer is at liberty to form a company, in order to make a caravan. He in whose name it is raised, is considered as the caravan bachi, or chief of the caravan, unless he appoint some other in his place. If there are several merchants equally concerned, they elect a caravan bachi; after which, they appoint officers to conduct the caravan and decide all controversies that may arise during the journey.

There are also sea caravans; established on the same footing, and for the same purposes: such is the caravan of vessels from Constantinople to Alexandria.

CARAVANSERA, or KARAVANSERA, a place appointed for receiving and loading the caravans.

It is commonly a large square building, in the middle of which there is a very spacious court; and under the arches or piazzas that surround it there runs a bank raised some feet above the ground, where the merchants, and those who travel with them in any capacity, take up their lodgings as well as they can; the beasts of burden being tied to the foot of the bank. Over the gates that lead into the court, there are sometimes little rooms, which the keepers of the caravanseras let out at a very high price to such as have a mind to be private.

The caravanseras in the East are something of the nature of the inns in Europe; only that you meet with little accommodation either for man or beast, but are obliged to carry almost every thing with you: there is never a caravansera without a well, or spring of water. These buildings are chiefly owing to the charity of the Mahometans; they are esteemed sacred dwellings, where it is not permitted to insult any person, or to pillage any of the effects that are deposited there. There are also caravanseras where most things may be had for money; and as the profits of these are considerable, the magistrates of the cities to whose jurisdiction they belong, take care to store them well. There is an inspector, who, at the departure of each caravan, fixes the price of the night's lodging, from which there is no appeal.



CARAVANSERASKIER, the steward or keeper of a CARAVANSERA. He keeps an account of all the merchandises that are sold upon trust, and demands the payments of the sums due to the merchants for what has been sold in the caravansera, on the seller's paying two per cent.

CARAVEL; thus they call a small vessel on the coast of France, which goes to fish for herring on the banks. They are commonly from 25 to 30 tons burden. Those which are designed for the same fishery in the British channel are called by the French *trinquarts*: these are from 12 to 15 tons burden.

CARAWAY, in botany. See CARUM.

CARBONADE, or CARBONADO, in cookery; flesh, fowl, or the like, seasoned and broiled on the coals.

CARBUNCLE, in natural history, a very elegant gem, whose colour is deep red, with an admixture of scarlet.

This gem was known among the ancients by the name of *anthrax*. It is usually found pure and faultless, and is of the same degree of hardness with the sapphire: it is naturally of an angular figure; and is found adhering, by its base, to a heavy and ferruginous stone of the emery kind: its usual size is near a quarter of an inch in length, and two thirds of that in diameter in its thickest parts: when held up against the sun, it looses its deep tinge, and becomes exactly of the colour of a burning charcoal, whence the propriety of the name which the ancients gave it. It bears the fire unaltered, not parting with its colour, nor becoming at all the paler by it. It is found only in the East Indies, so far as is yet known; and there but very rarely.

CARBUNCLE, or *Anthrax*, in medicine, an inflammation which arises, in time of the plague, with a vesicle or blister almost like that produced by burning.

CARBUNCLE, in heraldry, a charge or bearing, consisting of eight radii, four whereof make a common cross, and the other four a saltier.

Some call these radii *buttons*, or staves, because round, and enriched with buttons, or pearled like pilgrim's staves, and frequently tipped or terminated with flower-de-luces; others blazon them, royal sceptres, placed in saltier, pale and fesse.

CARCASSE, or CARCUS, in the art of war, an iron case, or hollow capacity, about the bigness of a bomb, of an oval figure, made of ribs of iron, filled with combustible matters, as meal-powder, saltpetre, sulphur, broken glass, shavings of horn, turpentine, tallow, &c. It has two or three apertures out of which the fire is to blaze; and the design of it is to be thrown



out

Carcassonne ‖ Carceres.

out of a mortar to set houses on fire, and do other execution. It has the name *carcasse*; because the circles which pass from one ring or plate to the other seem to represent the ribs of a human carcase.

CARCASSONNE, an ancient city of France, in Lower Languedoc, with a bishop's see. It is divided into the upper and lower town. They are both surrounded with walls: and though their situations are different they are both watered by the river Aude. The upper town is seated on a hill, with a castle that commands it, as well the lower town. It is strong, not only by its situation on a craggy rock, but also by several large towers which are joined to its walls, and which render it of difficult access. The cathedral church is remarkable for nothing but its antiquity. The lower town is large, and built after the modern taste. The streets are very straight, and lead to a large square in the middle, from whence may be seen the four gates of the town. There is here a manufacture of cloth. The neighbouring country is full of olive-trees; and in the mountains there is a fine marble, commonly called *marble of Languedoc*. E. Long 2. 25. N. Lat. 43. 11.

This place bore a considerable share in that celebrated crusade undertaken against the Albigenses in the beginning of the 13th century, and which forms one of the most astonishing instances of superstition and of atrocious barbarity to be found in the annals of the world. When the royal power was nearly annihilated, during the reigns of the last kings of the Carlovingian race in France, most of the cities of Languedoc erected themselves into little independent states, governed by their own princes. Carcassonne was then under the dominion of viscounts. At the time when Pope Innocent III. patronized and commanded the prosecution of hostilities against the Albigenses for the crime of heresy, Raymond the reigning viscount was included in that proscription. Simon de Montfort, general of the army of the church, invested the city of Carcassonne in 1209. The inhabitants terrified at the fate of several other places where the most dreadful massacres had been committed, demanded leave to capitulate; but this act of mercy was only extended to them under a condition equally cruel, incredible, and unparalleled in history, if we were not compelled to believe it by the unanimous testimony of all the cotemporary writers. The people found in the place were all obliged, without distinction of rank or sex, to evacuate it in a state of nudity; and Agnes the viscountess was not exempted, though young and beautiful, from this ignominious and shocking punishment. "On les fit sortir tout nuds de la ville de Carcassonne (says an ancient author) afin qu'ils receussent de la honte, en montrant ces parties du corps que la pureté de la langue n'exprime point, desquelles ils avoient abusé, et s'en étoient servis dans des crimes execrables." It seems by this imputation that the Albigeois were accused by their enemies of some enormities, probably unjust, and similar to those which religious enmity and prejudice have attributed to the followers of Zinzendorf in the present century.

CARCERES, in the ancient Circensian games, were inclosures in the circus, wherein the horses were restrained till the signal was given for starting, when, by an admirable contrivance, they all at once flew open.

Carchemish ‖ Cards.

CARCHEMISH, (anc geog.) a town lying upon the Euphrates, and belonging to the Assyrians. Necho king of Egypt took it from the king of Assyria, 2 Chr. xxxv. 20. Necho left a garrison in it, which was taken and cut to pieces, in the fourth year of Jehoiachan king of Judah, by Nebuchadnezzar king of Babylon, 2 Kings xxiii. 29. Isaiah (x. 9.) speaks of Carchemish, and seems to say that Tiglath-pileser made a conquest of it, perhaps from the Egyptians. This is thought to be the same city with that called Circesium by the Greeks and Latins.

CARCINOMA, in medicine; the same with CANCER.

CARD, among artificers, an instrument consisting of a block of wood, beset with sharp teeth, serving to arrange the hairs of wool, flax, hemp, and the like: there are different kinds of them, as hand-cards, stock-cards, &c. They are made as follows:

A piece of thick leather, of the size intended for the card, is strained in a frame for that purpose; and then pricked full of holes, into which the teeth or pieces of iron wire are inserted. After which the leather is nailed by the edges to a flat piece of wood, in the form of an oblong square, about a foot in length and half a foot in breadth, with a handle placed in the middle of one of the longer sides.

The teeth are made in the following manner. The wire being drawn of the size intended, a skain or number of wires are cut into proper lengths by means of a gauge, and then doubled in a tool contrived for that purpose: after which they are bent into the proper direction by means of another tool; and then placed in the leather as mentioned above.

CARDS, among gamesters, little pieces of fine thin pasteboard of an oblong figure, of several sizes; but most commonly, in Britain, three inches and an half long and two and an half broad, on which are painted several points and figures.

The moulds and blocks for making cards are exactly like those that were used for the first printed books. They lay a sheet of wet or moist paper on the block, which is first slightly done over with a sort of ink made of lamp-black diluted in water, and mixed with some starch to give it a body. They afterwards rub it off with a round list. The court-cards are coloured by means of several patterns, styled *stane-files*. They consist of papers cut through with a penknife; and in these apertures they apply severally the various colours, as red, black, &c. These patterns are painted with oil-colours, that the brushes may not wear them out; and when the pattern is laid on the pasteboard, they slightly pass over it a brush full of colour, which, leaving it within the openings, forms the face or figure of the card.

Among sharper, divers sorts of false and fraudulent cards have been contrived; as, 1. *Marked* cards, where the aces, kings, queens, knaves, are marked on the corners of the backs with spots of different number and order, either with clear water, or water tinged with pale Indian ink, that those in the secret may distinguish them. Aces are marked with single spots on two corners opposite diagonally; kings with two spots at the same corners; knaves with the same number transversed. 2. *Breef* cards, those which are longer or broader than the rest; chiefly used at whist and piquet. The broad

broad cards are usually for kings, queens, knaves, and aces; the long for the rest. Their design is to direct the cutting to enable him in the secret to cut the cards disadvantageously to his adversary, and draw the person unacquainted with the fraud to cut them favourably for the sharper. As the pack is placed either endwise or sidewise to him that is to cut, the long or broad cards naturally lead him to cut to them. Breef cards are sometimes made thus by the manufacturer; but, in defect of these, sharpers pare all but the breefs with a penknife or razor. 3. *Corner bend*, denotes four cards turned down finely at one corner, to serve as a signal to cut by. 4. *Middle bend*, or Kingston-bridge, is where the tricks are bent two different ways, which causes an opening or arch in the middle, to direct likewise the cutting.

Cards were invented about the year 1390, to divert Charles VI. of France, who had fallen into a melancholy disposition. The inventor proposed, by the figures of the four suits or colours, as the Fench call them, to represent the four classes of men in the kingdom. By *cœurs* (hearts) are meant the *gens de choeur*, choir-men, or ecclesiastics; and therefore the Spaniards, who certainly received the use of cards from the French, have *copas*, or chalices, instead of hearts. The nobility, or prime military part of the kingdom, are represented by the ends or points of lances or pikes; and our ignorance of the meaning or resemblance of the figure induced us to call them *spades:* The Spaniards have *espadas*, swords, in lieu of pikes, which are of similar import. By diamonds are designed the order of citizens, merchants, or tradesmen, *carreaux*, (square stones, tiles, or the like): The Spaniards have a coin, *dineros*, which answers to it; and the Dutch call the French word *carreaux* "*streneen*," stones and diamonds, from the form. *Tresle*, the trefoil-leaf, or clover-grass (corruptly called *clubs*), alludes to the husbandmen and peasants. But how this suit came to be called *clubs* is not easily explained; unless, borrowing the game from the Spaniards, who have *bastos* (staves or clubs) instead of the trefoil, we give the Spanish signification to the French figure.

The history of the four kings, which the French, in drollery, sometimes call the *cards*, are David, Alexander, Cæsar, and Charles; which names were then, and still are, on the French cards. These respectable names represent the four celebrated monarchies of the Jews, Greeks, Romans, and Franks under Charlemagne. By the queens are intended Argine, Esther, Judith, and Pallas (names retained in the French cards), typical of birth, piety, fortitude, and wisdom, the qualifications residing in each person. *Argine* is an anagram for *regina*, queen by descent. By the knaves were designed the servants to knights (for *knave* originally meant only *servant*); but French pages and valets, now indiscreminately used by various orders of persons, were formerly only allowed to persons of quality, esquires (*escuires*), shield or armour bearers. Others fancy that the knights themselves were designed by those cards; because Hogier and Lahire, two names on the French cards, were famous knights at the time cards were supposed to have been invented.

*Deceptions with Cards.* See Legerdemain, sect. 1.

CARDAMINE, in botany: A genus of the siliquosa order, belonging to the tetradynamia class of plants; and in the natural method ranking under the 39th order, *Siliquosæ*. The siliqua parts asunder with a spring, and the valves roll spirally backward; the stigma is entire, and the calyx a little gaping. Of this there are 15 species; but the most remarkable is the pratensis, with a large purplish flower. This grows naturally in many parts of Britain, and is also called *cuckow-flower*. There are four varieties, viz. the single, with purple and white flowers, which are frequently intermixed in the meadows; and the double, of both colours. The single sorts are not admitted into gardens; but the double deserve a place, as making a pretty appearance during the time they are in flower. They will thrive in a moist shady border: and are propagated by parting their roots, which is best performed in autumn. They delight in a soft loamy soil, not too stiff. By some the plant is reckoned antiscorbutic.



CARDAMOM, in the Materia Medica. See Amomum.

CARDAN, (Jerom) one of the most extraordinary geniuses of his age, was born at Pavia on the 24th of September 1501. As his mother was not married, she tried every method to procure an abortion, but without effect. She was three days in labour, and they were at last obliged to cut the child from her. He was born with his head covered with black curled hair. When he was four years old, he was carried to Milan; his father being an advocate in that city. At the age of 20, he went to study in the university of that city; and two years afterwards he explained Euclid. In 1524, he went to Padua; and the same year he was admitted to the degree of master of arts: in the end of the following year, he took the degree of doctor of physic. He married about the year 1531. For ten years before, his impotency had hindered him from having knowledge of a woman; which was a great mortification to him. He attributed it to the evil influences of the planet under which he was born. When he enumerates, as he frequently does, the greatest misfortunes of his life, this ten years impotency is always one. At the age of 32, he became professor of mathematics at Milan. In 1539, he was admitted member of the college of physicians at Milan; in 1543, he read public lectures of medicine in that city, and at Pavia the year following; but discontinued them because he could not get payment of his salary, and returned to Milan. In 1552, he went into Scotland, having been sent for by the archbishop of St Andrew's, who had in vain applied to the French king's physicians, and afterwards to those of the emperor of Germany. This prelate, then 43 years old, had for ten years been afflicted with a shortness of breath, which returned every eight days for the two last years. He began to recover from the moment that Cardan prescribed for him. Cardan took his leave of him at the end of six weeks and three days, leaving him prescriptions which in two years wrought a complete cure.

Cardan's journey to Scotland gave him an opportunity of visiting several countries. He crossed France in going thither; and returned through Germany, and the Low Countries, along the banks of the Rhine. It was on this occasion he went to London, and calculated king Edward's nativity. This tour took up about four months: after which, coming back to Milan, he continued there till the beginning of October 1552;

and then went to Pavia, from whence he was invited to Bologna in 1562. He taught in this last city till the year 1570; at which time he was thrown into prison; but some months after he was sent home to his own house. He left Bologna in 1571: and went to Rome, where he lived for some time without any public employment. He was, however, admitted a member of the college of physicians, and received a pension from the pope. He died at Rome on the 21st of September 1575, according to Thuanus. This account might be sufficient to show the reader that Cardan was of a very fickle temper; but he will have a much better idea of his singular and odd turn of mind by examining what he himself has written concerning his own good and bad qualities. He paid himself congratulatory compliments for not having a friend in this world; but that, in requittal, he was attended by an aerial spirit, emaned partly from Saturn and partly from mercury, who was the constant guide of his actions, and teacher of every duty to which he was bound. He declared, too, that he was so irregular in his manner of walking the streets, as induced all beholders to point at him as a fool. Sometimes he walked very slowly, like a man absorbed in profound meditation; then all on a sudden quickened his steps, accompanying them with very absurd attitudes. In Bologna, his delight was to be drawn about in a mean vehicle with three wheels. When nature did not visit him with any pain, he would procure to himself that disagreeable sensation by biting his lips so wantonly, or pulling his fingers to such a vehement degree, as sometimes to force the tears from his eyes: and the reason he assigned for so doing, was to moderate certain impetuous sallies of the mind, the violence of which was to him by far more insupportable than pain itself; and that the sure consequence of such a severe discipline was the enjoying the pleasure of health. He says elsewhere, that, in his greatest tortures of soul, he used to whip his legs with rods, and bite his left arm; that it was a great relief to him to weep, but that very often he could not; that nothing gave him more pleasure than to talk of things which made the whole company uneasy; that he spoke on all subjects, in season and out of season: and he was so fond of games of chance, as to spend whole days in them, to the great prejudice of his family and reputation, for he even staked his furniture and his wife's jewels.

Cardanus makes no scruple of owning that he was revengeful, envious, treacherous, a dealer in the black art, a backbiter, a calumniator, and addicted to all the foul and detestable excesses that can be imagined: yet, notwithstanding (as one would think) so humbling a declaration, there was never perhaps a vainer mortal, or one that with less ceremony expressed the high opinion he had of himself, than Cardanus was known to do, as will appear by the following proofs. "I have been admired by many nations: an infinite number of panegyrics, both in prose and verse, have been composed to celebrate my fame. I was born to release the world from the manifold errors under which it groaned. What I have found out could not be discovered either by my predecessors or my cotemporaries; and that is the reason why those authors who write any thing worthy of being remembered, scruple not to own that they are indebted to me for it. I have composed a book on the dialectic art, in which there is neither one superfluous letter nor one deficient. I finished it in seven days, which seems a prodigy. Yet where is there a person to be found, that can boast of his having become master of its doctrine in a year? And he that shall have comprehended it in that time, must appear to have been instructed by a familiar dæmon."



The same capriciousness observable in his outward conduct is to be observed in the composition of his works. We have a multitude of his treatises in which the reader is stopped almost every moment by the obscurity of his text, or his digressions from the point in hand. In his arithmetical performances there are several discourses on the motions of the planets, on the creation, and on the tower of Babel. In his dialectic work, we find his judgment on historians and the writers of epistles. The only apology which he makes for the frequency of his digressions is, that they were purposely done for the sooner filling up of his sheet, his bargain with the bookseller being at so much per sheet; and that he worked as much for his daily support as for the acquisition of glory. The Lyons edition of his works, printed in 1663, consists of ten volumes in folio.

It was Cardanus who revived in latter times all the secret philosophy of the Cabbala or Cabbalists, which filled the world with spirits; a likeness to whom, he asserted we might attain by purifying ourselves with philosophy. He chose for himself, however, notwithstanding such reveries, this fine device, *Tempus mea possessio, tempus meus ager:* "Time is my sole possession, and the only fund I have to improve."

In fact, when we consider the transcendent qualities of Cardan's mind, we cannot deny his having cultivated it with every species of knowledge, and his having made a greater progress in philosophy, in the medical art, in astronomy, in mathematics, &c. than the greatest part of his cotemporaries who had applied their minds but to one of those sciences.

Scaliger affirms, that Cardan, having fixed the time of his death, abstained from food, that his prediction might be fulfilled, and that his continuance to live might not discredit his art. Cardan's father, who was a doctor of medicine, and a professor of civil and canon law, died in the same manner, in the year 1524, having abstained from all sustenance for nine days. His son tells us, that he had white eyes, and could see in the night time.

CARDASS, a sort of card, proper for carding flocks of silk, to make cappadine of it. It is also the name which the French give to those flocks of silk.

CARDASSES, is also the name which, in the cloth manufactories of Languedoc, they give to a sort of large card, which is used for carding the dyed wool, designed for making cloth of mixed colours.

CARDERS, in the woollen manufactory, are persons who prepare wool, &c. for spinning, &c.

CARDERS, spinners, weavers, fullers, sheermen, and dyers, in England, not performing their duty in their occupations, shall yield to the party grieved double damages; to be committed until payment. One justice to hear and determine complaints.

CARDERS, combers, sorters, spinners, or weavers, con-

conveying away, embezzling, or detaining any wool or yarn, delivered by the clothier, or any other person, shall give the party grieved such satisfaction, as two justices, mayor, &c. shall think fit: if not able or willing to make satisfaction, for the first offence to be whipped, or set in the stocks in some market-town, or in any other town where the offence is committed: the second offence to incur the like, or such further punishment by whipping, &c. as justices shall think proper. Conviction by one witness on oath, or confession.

CARDI, (Ludovico). See CIVOLI.

CARDIAC, in a general sense, signifies all medicines beneficial to the heart, whether internally or externally applied. The word comes from the Greek word καρδια, *cor;* the heart being reputed the immediate seat of their operation.

CARDIACS, in a more particular sense, denote medicines which raise the spirits, and give present strength and cheerfulness; these amount to the same with what are popularly called *cordials*. Cardiacs are medicines anciently supposed to exert themselves immediately in comforting and strengthening the heart: but the modern physicians rather suppose them to produce the effect by putting the blood into a gentle fermentation, whereby the springs, before decayed, are repaired and invigorated, and the tone and elasticity of the fibres of the vessels restored; the consequence of which is a more easy and brisk circulation.

CARDIALGIA, in medicine, a violent sensation of heat or acrimony felt towards the upper or left orifice of the stomach, though seemingly at the heart; sometimes accompanied with palpitations of the heart, fainting, and a propensity to vomit: better known by the name of *cardiac passion*, or *heart-burn*. See *(Index subjoined to)* MEDICINE.

CARDIFF, a town of Glamorganshire, in South Wales, seated on the river Tave, in a rich and fruitful soil. It is a large, compact, well built town, having a castle, a wall, and four gates, built by Robert Fitz-Hamon, a Norman, about the year 1100. It is governed by the constable of the castle, 12 aldermen, 12 burgesses, &c. and sends one member to parliament. Here the assizes and sessions are held, besides several courts. There is a handsome bridge over the river, to which small vessels come to take in their lading. It has now only one church, St Mary's having been long since thrown down by the undermining of the river. The castle, though much decayed, makes a grand appearance even at this time; and the walls of the town are very strong and thick. The church has a fine tower-steeple, and the town-hall is a good structure. The magistrates are elected every year by the majority of the burgesses. W. Long. 3. 20. N. Lat. 51. 30. Cardiff gives title of British Baron to the family of Bute in Scotland.

CARDIGAN, the capital town of Cardiganshire, in South Wales, is seated near the mouth of the river Teivy, on the Irish channel. It is indifferently large and well built, containing three wards, one church, and the county-goal. It is governed by a mayor, 13 aldermen, 13 common-council-men, &c. Here are the ruins of a castle which was built by Gilbert de Clare, about the year 1160. It sends one member to parliament; and has two markets, held on Tuesdays and Saturdays. W. Long. 4. 38. N. Lat. 52. 15.



CARDIGANSHIRE, a county of South Wales, bounded on the North by Merionethshire and Montgomeryshire, on the east by Radnorshire and Brecknockshire, on the west by the Irish Sea, and on the south by Caermarthenshire. Its length from Northwest to south-east is about 44 miles, and its breadth near 20. The air, as in other parts of Wales, varies with the soil, which in the southern and western parts is more upon a level than this principality generally is, which renders the air mild and temperate. But as the northern and eastern parts are mountainous, they are consequently more barren and bleak. However, there are cattle bred in all parts; but they have neither wood nor coals of their own for fuel: they have rich lead mines, and fish in plenty, with fowls both tame and wild. The principal rivers are the Teivy, the Ridol, and the Istwith. This county hath five market-towns, viz. Cardigan, Aberistwith, Llanbadarnvawn, Llanbedar, and Tregaron, with 77 parishes; and was formerly computed to have upward of 3000 houses, and 520,000 acres of land. It sends two members to parliament; one for the county, and one for Cardigan.

CARDINAL, in a general sense, an appellation given to things on account of their pre-eminence. The word is formed of the Latin *cardo, a hinge;* it being on these fundamental points that all the rest of the same kind are supposed to turn. Thus, justice, prudence, temperance, and fortitude, are called the four *cardinal virtues*, as being the basis of all the rest.

CARDINAL *Flower*, in botany. See LOBELIA.

CARDINAL *Points*, in cosmography, are the four intersections of the horizon with the meridian, and the prime vertical circle. Of these, two, viz. the intersections of the horizon and meridian, are called *North* and *South*, with regard to the poles they are directed to. The other two, viz. the intersections of the horizon, and first vertical, are called *East* and *West*.

The cardinal points, therefore, coincide with the four cardinal regions of the heavens; and are 90° distant from each other. The intermediate points are called *collateral points*.

CARDINAL *Points*, in astrology, are the rising and setting of the sun, the zenith, and nadir.

CARDINAL *Signs*, in astronomy, are Aries, Libra, Cancer, and Capricorn.

CARDINAL *Winds*, are those that blow from the cardinal points.

CARDINAL *Numbers*, in grammar, are the numbers one, two, three, &c. which are indeclinable; in opposition to the ordinal numbers, first, second, third, fourth, &c.

CARDINAL, an ecclesiastical prince in the Romish church, being one who has a voice in the conclave at the election of a pope. Some say the cardinals were so called from the Latin *incardinatio*, which signifies the adoption in any church made of a priest of a foreign church, driven thence by misfortune; and add, that the use of the word commenced at Rome and Ravenna; the revenues of the churches of which cities being very great, they became the common refuge of the unhappy priests of all other churches.

The cardinals compose the pope's council or senate: in the Vatican is a constitution of pope John, which regulates the rights and titles of the *cardinals;* and

Cardinal. which declares, that as the pope represents Moses, so the cardinals represent the seventy elders, who, under the pontifical authority, decide private and particular differences.

Cardinals, in their first institution, were only the principal priests, or incumbents of the parishes of Rome. In the primitive church, the chief priest of a parish, who immediately followed the bishop, was called *presbyter cardinalis*, to distinguish him from the other petty priests, who had no church nor preferment; the term was first applied to them in the year 150; others say, under pope Silvester, in the year 300. These cardinal priests were alone allowed to baptize, and administer the eucharist. When the cardinal priests became bishops, their cardinalate became vacant; they being then supposed to be raised to a higher dignity.—Under pope Gregory, cardinal priests, and cardinal deacons, were only such priests or deacons as had a church or chapel under their particular care: and this was the original use of the word. Leo IV. in the council of Rome, held in 853, calls them *presbyteros sui cardinis*; and their churches, *parochias cardinales*.

The cardinals continued on this footing till the eleventh century: but as the grandeur and state of his holiness became then exceedingly augmented, he would have his council of cardinals make a better figure than the ancient priests had done. It is true, they still preserved their ancient title; but the thing expressed by it was no more. It was a good while, however, before they had the precedence over bishops, or got the election of the pope into their hands: but when they were once possessed of those privileges, they soon had the red hat and purple; and growing still in authority, they became at length superior to the bishops, by the sole quality of being cardinals.

Du-Cange observes, that originally there were three kinds of churches: the first or genuine churches were properly called *parishes*; the second, *deaconries*, which were chapels joined to hospitals, and served by deacons; the third were simple *oratories*, where private masses were said, and were discharged by local and resident chaplains. He adds, that, to distinguish the principal or parish churches from the chapels and oratories, the name *cardinales* was given to them. Accordingly, parish churches gave titles to cardinal priests; and some chapels also, at length, gave the title of *cardinal deacons*.

Others observe, that the term *cardinal* was given not only to priests, but also to bishops and deacons who were attached to certain churches, to distinguish them from those who only served them *en passant*, and by commission. Titular churches, or benefices, were a kind of parishes, i. e. churches assigned each to a cardinal priest; with some stated district depending on it, and a font for administering of baptism, in cases where the bishop himself could not administer it. These cardinals were subordinate to the bishops; and accordingly, in councils, particularly that held at Rome in 868, subscribed after them.

It was not, however, only at Rome, that priests bore this name; for we find there were cardinal priests in France: thus, the curate of the parish of St John de Vignes is called in old charters the *cardinal priest* of that parish.

The title of *cardinal* is also given to some bishops, *quatenus* bishops; e. g. to those of Mentz and Milan: the archbishop of Bourges is also, in ancient writings, called *cardinal*; and the church of Bourges, a *cardinal church*. The abbot of Vendome calls himself *cardinalis natus*.

The cardinals are divided into three classes or orders; containing six bishops, fifty priests, and fourteen deacons; making in all seventy: which constitute what they call the *sacred college*. The cardinal bishops, who are, as it were, the pope's vicars, bear the titles of the bishoprics assigned to them; the rest take such titles as are given them: the number of cardinal bishops has been fixed; but that of cardinal priests and deacons, and consequently the sacred college itself, is always fluctuating. Till the year 1125, the college only consisted of fifty-two or fifty-three: the council of Constance reduced them to twenty-four; but Sixtus IV. without any regard to that restriction, raised them again to fifty-three, and Leo to sixty-five. Thus, as the number of cardinal priests was anciently fixed to twenty-eight, new titles were to be established, in proportion as new cardinals were created. As for the cardinal deacons, they were originally no more than seven for the fourteen quarters of Rome; but they were afterwards increased to nineteen, and after that were again diminished.

According to Onuphrius, it was pope Pius IV. who first enacted, in 1562, that the pope should be chosen only by the senate of cardinals; whereas, till that time, the election was by all the clergy of Rome. Some say, the election of the pope rested in the cardinals, exclusive of the clergy, in the time of Alexander III. in 1160. Others go higher still, and say, that Nicholas II. having been elected at Sienna, in 1058, by the cardinals alone, occasioned the right of election to be taken from the clergy and people of Rome; only leaving them that of confirming him by their consent; which was at length, however, taken from them. See his decree for this purpose, issued in the Roman council of 1059, in Hardouin's Acta Conciliorum, tom. vi. pt. i. p. 1165. Whence it appears, that the cardinals who had the right of suffrage in the election of his successors, were divided by this pontiff into *cardinal bishops* and *cardinal clerks*: meaning by the former the seven bishops who belonged to the city and territory of Rome; and by the latter, the *cardinal presbyters*, or ministers of the twenty-eight Roman parishes, or principal churches. To these were added, in process of time, under Alexander III. and other pontiffs, new members, in order to appease the tumults occasioned by the edict of Nicholas II.

At the creation of a new cardinal, the pope performs the ceremony of opening and shutting his mouth; which is done in a private consistory. The shutting his mouth implies the depriving him of the liberty of giving his opinion in congregations; and the opening his mouth, which is performed 15 days after, signifies the taking off this restraint. However, if the pope happens to die during the time a cardinal's mouth is shut, he can neither give his voice in the election of a new pope, nor be himself advanced to that dignity.

The dress of the cardinal is a red soutanne, a rocket, a short purple mantle, and a red hat.

The

The cardinals began to wear the red hat at the council of Lyons, in 1243. The decree of pope Urban VIII. whereby it is appointed, that the cardinals be addressed under the title of *eminence*, is of the year 1630; till then, they were called *illustrissimi*.

When cardinals are sent to the courts of Princes, it is in quality of legates *a latere*; and when they are appointed governors of towns, their government is called by the name of *legation*.

CARDINAL has also been applied to secular officers. Thus, the prime ministers in the court of the emperor Theodosius, are called *cardinales*. Cassiodorus, lib. vii. formul. 31. makes mention of the cardinal prince of the city of Rome; and in the list of officers of the duke of Bretagne, in 1147, we meet with one Raoul de Thorel, cardinal of Quillart, chancellor, and servant of the viscount de Rohan: which shows it to have been an inferior quality.

CARDIOID, in the higher geometry, an algebraical curve, so called from its resemblance to an heart.

CARDIOSPERMUM, in botany: A genus of the trigynia order, belonging to the octandria class of plants; and in the natural method ranking under the 39th order, *Trihilatæ*. The calyx is tetraphyllous, the petals four, the nectarium tetraphyllous and unequal; the capsules three, grown together, and inflated. There are two species, both natives of the East and West Indies; but have no great beauty, or any other remarkable property.

CARDIUM, or COCKLE, in zoology, a genus of insects belonging to the order of vermes testaceæ. The shells consists of two equal valves, and the sides are equal. There are 21 species of this genus. Common on all sandy coasts, lodged a little beneath the sand; their place marked by a depressed spot. They are wholesome and delicious food.

CARDONA, a handsome town of Spain, in Catalonia, with a strong castle, and the title of a duchy. Near it is an inexhaustible mountain of salt of several colours, as red, white, carnation, and green: but when washed, it becomes white. There are also vineyards which produce excellent wine, and very lofty pine-trees. It is seated on an eminence, near the river Cardenero. E. Long. 1. 26. N. Lat. 41. 42.

CARDUUS, in botany: A genus of the polygamia æqualis order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The calyx is ovate, imbricated with prickly scales, and the receptacle hairy. Of this genus there are 26 species, ten of which are natives of Britain, and being troublesome weeds require no description. Some few of the exotic kinds are propagated in gardens for the sake of variety; but even these have neither beauty nor any other property to recommend them.

*CARDUUS Benedictus*. See CNICUS.

CAREENING, in the sea-language, the bringing a ship to lie down on one side, in order to trim and caulk the other side.

A ship is said to be brought to the careen, when, the most of her lading being taken out, she is hulled down on one side, by a small vessel, as low as necessary; and there kept by the weight of the ballast, ordnance, &c. as well as by ropes, lest her masts should be strained too much; in order that her sides and bottom may be trimmed, seams caulked, or any thing that is faulty under water mended. Hence, when a ship lies on one side when she sails, she is said to sail on the careen.

CAREER, in the manege, a place inclosed with a barrier, wherein they run the ring.

The word is also used for the race or course of the horse itself, provided it do not exceed 200 paces.

In the ancient circus, the career was the space the bigæ, or quadrigæ, were to run at full speed, to gain the prize. See CIRCUS.

CAREER, in falconry, is a flight or tour of the bird, about 120 yards. If she mounts more, it is called a *double career*; if less, a *semi-career*.

CARELIA, the eastern province of Finland; divided into Swedish Carelia, and Muscovite Carelia. The capital of the latter is Povenza, and of the former Weiburg.

CARELSCROON, a sea-port town of Sweden, in Blekingia, or Bleking, on the Baltic Sea, with a very good harbour defended by two forts. It was built in 1679, and is very populous, with arsenals for the marine: the house of the director-general of the admiralty is in this town, and here the Swedee lay up their royal navy. E. Long. 15. 5. N. Lat. 56. 15.

CARENTAN, a town of France in Lower Normandy, and in the Contentin, with an ancient castle. W. Long. 1. 14. N. Lat. 49. 20.

CARET, among grammarians, a character marked thus ʌ, signifying that something is added on the margin, or interlined, which ought to come in where the caret stands.

CAREW, (George) born in Devonshire in 1557, an eminent commander in Ireland, was made president of Munster by queen Elizabeth; when, joining his forces with the earl of Thomond, he reduced the Irish insurgents, and brought the earl of Desmond to his trial. King James made him governor of Guernsey, and created him a baron. As he was a valiant commander, he was no less a polite scholar; and wrote *Pacata Hibernia*, a history of the late wars in Ireland, printed after his death, in 1633. He made several collections for a history of Henry V. which are digested into Speed's History of Great Britain. Besides these, he collected materials of Irish history in four large MSS. volumes now in the Bodleian library, Oxford.

CAREW, (Thomas) descended from the family of Carew in Gloucestershire, was gentleman of the privy chamber to Charles I. who always esteemed him one of the most celebrated wits of his court. He was much respected by the poets of his time, particularly by Ben Johnson and Sir William Davenant; and left behind him several poems, and a masque called *Cœlum Britannicum*, performed at Whitehall on Shrove Tuesday night, 1633, by the king, and several of his nobles with their sons. Carew was assisted in the contrivance by Inigo Jones, and the music was set by Mr Henry Lawes of the king's chapel. He died in the prime of life, about the year 1639.

CAREW, (Richard) author of the "Survey of Cornwall," was the eldest son of Thomas Carew of East Anthony, and was born in 1555. When very young, he became a gentleman commoner of Christ-church college, Oxford; and at 14 years of age had the honour of disputing, extempore, with the afterwards famous

Carew.

mous Sir Philip Sydney, in the presence of the earls of Leicester, Warwick, and other nobility. After spending three years at the university, he removed to the Middle Temple, where he resided the same length of time, and then travelled into foreign parts. Not long after his return to England, he married, in 1577, Juliana Arundel, of Trerice. In 1581, Mr Carew was made justice of the peace, and in 1586 was appointed high-sheriff of the county of Cornwall; about which time he was likewise queen's deputy for the militia. In 1589, he was elected a member of the college of Antiquaries, a distinction to which he was intitled by his literary abilities and pursuits. What particularly engaged his attention was his native county, his "Survey" of which was published, in 4to, at London, in 1602. It hath been twice reprinted, first in 1723, and next in 1769. Of this work Cambden hath spoken in high terms, and acknowledges his obligations to the author. In the present improved state of topographical knowledge, and since Dr Borlase's excellent publications relative to the county of Cornwall, the value of Carew's "Survey" must have been greatly diminished. Mr Gough remarks, that the history and monuments of this county were faintly touched by Carew; but it is added, that he was a person extremely capable of describing them, if the infancy of those studies at that time had afforded light and materials. Another work of our author was a translation from the Italian, intitled, "The Examination of Men's Wits. In which, by discovering the variety of natures, is showed for what profession each one is apt, and how far he shall profit therein." This was published at London in 1594, and afterwards in 1604; and tho' Richard Carew's name is prefixed to it, hath been principally ascribed by some persons to his father. According to Wood, Carew wrote also, "The true and ready Way to learn the Latin Tongue," in answer to a query, whether the ordinary method of teaching the Latin by the rules of grammar be the best mode of instructing youths in that language? This tract is involved in Mr Hartlib's book upon the same subject, and with the same title. It is certain that Carew was a gentleman of considerable abilities and literature, and that he was held in great estimation by some of the most eminent scholars of his time. He was particularly intimate with Sir Henry Spelman, who extols him for his ingenuity, virtue, and learning.

CAREW, (George) brother to the subject of the last article, was educated in the university of Oxford, after which he studied the law in the inns of court, and then travelled to foreign countries for farther improvement. On his return to his native country, he was called to the bar, and after some time was appointed secretary to Sir Christopher Hatton lord chancellor of England. This was by the especial recommendation of queen Elizabeth herself, who gave him a prothonotaryship in the chancery, and conferred upon him the honour of knighthood. In 1597, Sir George Carew, who was then a master in chancery, was sent ambassador to the king of Poland. In the next reign, he was one of the commissioners for treating with the Scotch concerning an union between the two kingdoms; after which he was appointed ambassador to the court of France, where he continued from the latter end of the year 1605 till 1609. During his residence in that country, he formed an intimacy with Thuanus, to whom he communicated an account of the transactions in Poland whilst he was employed there, which was of great service to that admirable author in drawing up the 21st book of his history. After Sir George Carew's return from France, he was advanced to the important post of master of the court of Wards, which honourable situation he did not long live to enjoy; for it appears from a letter written by Thuanus to Cambden in the spring of 1613, that he was then lately deceased. Sir George Carew married Thomasine, daughter of Sir Francis Godolphin, great grandfather of the lord treasurer Godolphin, and had by her two sons and three daughters. When Sir George Carew returned, in 1609, from his French embassy, he drew up, and addressed to James I. "A Relation of the State of France, with the characters of Henry IV. and the principal Persons of that Court." The characters are drawn from personal knowledge and close observation, and might be of service to a general historian of that period. The composition is perspicuous and manly, and entirely free from the pedantry which prevailed in the reign of James I. but this is the less surprising, as Sir George Carew's taste had been formed in a better æra, that of queen Elizabeth. The valuable tract we are speaking of lay for a long time in MS. till happily falling into the hands of the earl of Hardwicke, it was communicated by him to Dr Birch, who published it, in 1749, at the end of his "Historical View of the Negociations between the Courts of England, France, and Brussels, from 1592 to 1617." That intelligent and industrious writer justly observes, that it is a model upon which ambassadors may form and digest their notions and representations; and the late celebrated poet Mr Gray hath spoken of it as an excellent performance.

Carew. Carey.

CAREY, (Harry) a man distinguished by both poetry and music, but perhaps more so by a certain facetiousness, which made him agreeable to every body. He published in 1720 a little collection of poems; and in 1732, six cantatas, written and composed by himself. He also composed sundry songs for modern comedies, particularly those in the "Provoked Husband:" he wrote a farce called "The Contrivances," in which were several little songs to very pretty airs of his own composition: he also made two or three little dramas for Goodman's-fields theatre, which were very favourably received. In 1729, he published by subscription his poems much enlarged: with the addition of one intitled "Namby Pamby," in which Ambrose Philips is ridiculed. Carey's talents, says his historian, lay in humour and unmalevolent satire: to ridicule the rant and bombast of modern tragedies he wrote one, to which he gave the strange title of "Chrononhotonthologos," acted in 1734. He also wrote a farce called "The Honest Yorkshireman." Carey was a thorough Englishman, and had an unsurmountable aversion to the Italian opera and the singers in it: he wrote a burlesque opera on the subject of the "Dragon of Wantley;" and afterwards a sequel to it, intitled, "The Dragoness;" both which were esteemed a true burlesque upon the Italian opera. His qualities being of the entertaining kind, he was led into

Cargadors || Caribbee islands.

to more expences than his finances could bear, and thus was frequently in distress. His friends however were always ready to assist him by their little subscriptions to his works: and encouraged by these, he republished, in 1740, all the songs he had ever composed, in a collection, intitled, "The Musical Century, in 100 English Ballads, &c." and, in 1743, his dramatic works, in a small volume, 4to. With all his mirth and good-humour, he seems to have been at times deeply affected with the malevolence of some of his own profession, who, for reasons that no one can guess at, were his enemies: and this, with the pressure of his circumstances, is supposed to have occasioned his untimely end; for, about 1744, in a fit of desperation, he laid violent hands on himself, and, at his house in Warner-street, Cold-bath Fields, put a period to a life, which, says Sir John Hawkins, had been led without reproach. It is to be noted, and it is somewhat singular in such a character, that in all his songs and poems on wine, love, and such kind of subjects, he seems to have manifested an inviolable regard for decency and good manners.

CARGADORS, a name which the Dutch give to those brokers whose business is to find freight for ships outward bound, and to give notice to the merchants, who have commodities to send by sea, of the ships that are ready to sail, and of the places for which they are bound.

CARGAPOL, or KARGAPOL, the capital of a territory of the same name, in the province of Dwina, in Muscovy: E. Long. 36°. N. Lat. 63°.

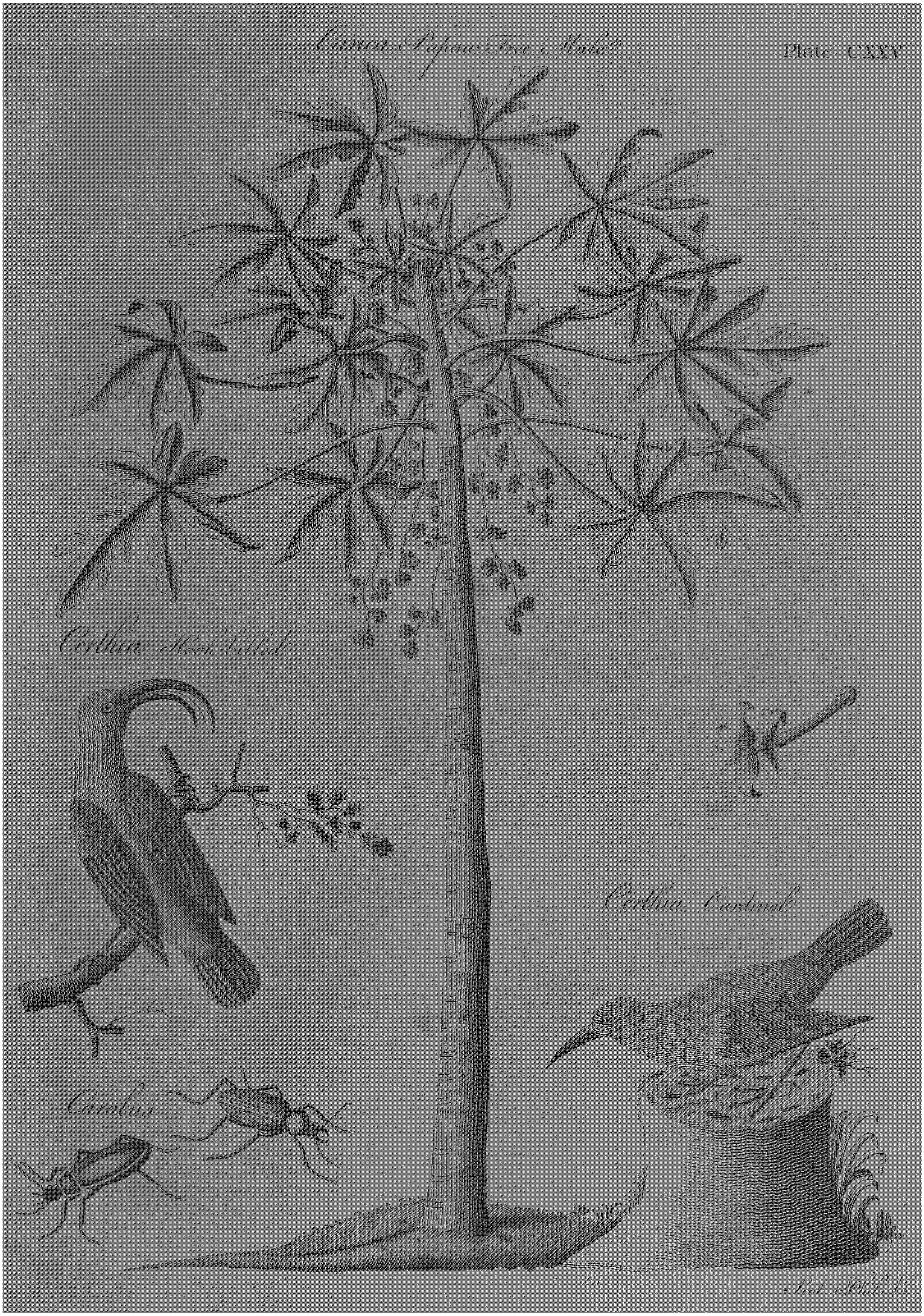
CARGO denotes all the merchandises and effects which are laden on board a ship.

*Super-Cargo*, a person employed by merchants to go a voyage, oversee the cargo, and dispose of it to the best advantage.

CARIA, (anc. geog.) a country of the Hither Asia; whose limits are extended by some, while they are contracted by others. Mela, Pliny, extend the maritime Caria from Jasus and Halicarnassus, to Calynda, and the borders of Lycia. The inland Caria Ptolemy extends to the Meander and beyond. *Car*, *Cariates*, *Cariatis*, *Carissa*, and *Caris*, and *Caira*, are the gentilitious names: *Carias* and *Caricus* the epithets. *In Care periculum*, was a proverbial saying on a thing exposed to danger, but of no great value. The *Cares* being the Swiss of those days, were hired and placed in the front of the battle, (Cicero.) *Cum Care Carissa*, denoted the behaviour of clowns. The Cares came originally from the islands to the continent, being formerly subject to Minos, and called *Leleges*: this the Cretans affirm, and the Cares deny, making themselves aborigines. They are of a common original with the Mysi and Lydi, having a common temple, of a very ancient standing, at Melassa, a town of Caria, called *Jovis Carii Delubrum*, (Herodotus.) Homer calls the Carians, barbarians in language.

CARIATI, a town of Italy, in the kingdom of Naples, and province of Hither Calabria, with a bishop's see, and the title of a principality. It is two miles from the gulf of Taranto, and 37 north-east of Cosenza. E. Long. 17. 19. N. Lat. 30. 38.

CARIBBEE ISLANDS, a cluster of islands situated in the Atlantic ocean between 59 and 63 degrees of west longitude, and between 11 and 18 degrees of north latitude. They lie in the form of a bow or semicircle, stretching almost from the coast of Florida north, to near the river Oroonoque. Those that lie nearest the east have been called the *Windward Islands*, the others the *Leeward*, on account of the winds blowing generally from the eastern point in those quarters. Abbe Raynal conjectures them to be the tops of very high mountains formerly belonging to the continent, which have been changed into islands by some revolution that has laid the flat country under water. The direction of the Caribbee islands, beginning from Tobago, is nearly north and N. N. W. This direction is continued forming a line somewhat curved towards the north west, and ending at Antigua. In this place the line becomes at once curved; and extending itself in a straight direction to the west and north west, meets in its course with Porto-Rico, St Domingo, and Cuba, known by the name of the *Leeward Islands*, which are separated from each other by channels of various breadths. Some of these are six, others 15 or 20 leagues broad: but in all of them the soundings are from 100 to 120 or 150 fathoms. Between Grenada and St Vincent's there is also a small archipelago of 30 leagues, in which the soundings are not above ten fathom. The mountains in the Caribbee islands run in the same direction as the islands themselves. The direction is so regular, that if we were to consider the tops of these mountains only, independent of their bases, they might be looked upon as a chain of hills belonging to the continent, of which Martinico would be the most northwesterly promontory. The springs of water which flow from the mountains in the Windward Islands, run all in the western parts of these islands. The whole eastern coast is without any running water. No springs come down there from the mountains: and indeed they would have there been useless; for after having run over a very short tract of land, and with great rapidity, they would have fallen into the sea. In Porto Rico, St Domingo, and Cuba, there are a few rivers that discharge themselves on the northern side, and whose sources rise in the mountains running from east to west, that is, thro' the whole length of these islands. From the other side of the mountains facing the south, where the sea, flowing with great impetuosity, leaves behind it marks of its inundations, several rivers flow down, the mouths of which are capable of receiving the largest ships. The soil of the Caribbees consists mostly of a layer of clay or gravel of different thickness; under which is a bed of stone or rock. The nature of some of those soils is better adapted to vegetables than others. In those places where the clay is drier and more friable, and mixes with the leaves and remains of plants, a layer of earth is formed of greater depth than where the clay is moister. The sand or gravel has different properties according to its peculiar nature: wherever it is less hard, less compact, and less porous, small pieces separate themselves from it, which, though dry, preserve a certain degree of coolness useful to vegetation. This soil is called in America a *pumice-stone* soil. Wherever the clay and gravel do not go through such modifications, the soil becomes barren, as soon as the layer formed by the decomposition of the original plants is destroyed.—By a treaty concluded in January 1660, between


Carica Papaw Tree Male
Certhia Hook-billed
Certhia Cardinal
Carabus
Scot Philad
Plate CXXV

Caribbee. between the French and English, the Caribs were confined to the islands of St Vincent's and Dominica, where all the scattered body of this people were united, and at that time did not exceed in number 6000 men. See St Vincent's and Dominica.

As the Caribbee islands are all between the tropics, their inhabitants are exposed, allowing for the varieties resulting from difference of situation and soil, to a perpetual heat, which generally increases from the rising of the sun till an hour after noon, and then declines in proportion as the sun declines. The variations of the temperature of the air seem to depend rather on the wind than on the changes of the seasons. In those places where the wind does not blow, the air is excessively hot, and none but the easterly winds contribute to temper and refresh it: those that blow from the south and west afford little relief; but they are much less frequent and less regular than that which blows from the east. The branches of the trees exposed to the influence of the latter are forced round towards the west: but their roots are stronger, and more extended under the ground, towards the east than towards the west; and hence they are easily thrown down by strong west winds or hurricanes from that quarter. The easterly wind is scarce felt in the Caribbee islands before 9 or 10 o'clock in the morning, increases in proportion as the sun rises above the horizon, and decreases as it declines. Towards the evening it ceases entirely to blow on the coasts, but not on the open sea. It has also been observed, that it blows with more force, and more regularity, in the dog-days than at any other time of the year.

The rain also contributes to the temperature of the Caribbee islands, though not equally in them all. In those places where the easterly wind meets with nothing to oppose its progress, it dispels the clouds as they begin to rise, and causes them to break either in the woods or upon the mountains. But whenever the storms are too violent, or the blowing of the easterly wind is interrupted by the changeable and temporary effect of the southerly and westerly ones, it then begins to rain. In the other Caribbee islands, where this wind does not generally blow, the rains are so frequent and plentiful, especially in the winter season, which lasts from the middle of July to the middle of October, that, according to the most accurate observations, as much rain falls in one week, as in our climates in a year. Instead of those mild refreshing showers which fall in the European climates, the rains of the Caribbee islands are torrents, the sound of which might be mistaken for hail, were not that almost totally unknown under so burning a sky. These showers indeed refresh the air; but they occasion a dampness, the effects of which are not less disagreeable than fatal. The dead must be interred within a few hours after they have expired. Meat will not keep sweet above 24 hours. The fruits decay, whether they are gathered ripe or before their maturity. The bread must be made up into buiscuits, to prevent its growing mouldy. Common wines turn sour, and iron turns rusty, in a day's time. The seeds can only be preserved by constant attention and care, till the proper season returns for sowing them. When the Caribbee islands were first discovered, the corn that was conveyed there for the support of the Europeans, was so soon damaged, that it became necessary to send it out in the ears. This necessary precaution so much enhanced the price of it, that few were able to purchase it. Flour was then substituted in lieu of corn; which lowered indeed the expences of transport, but had this inconvenience, that it was sooner damaged. It was imagined by a merchant, that if the flour were entirely separated from the bran, it would have the double advantage of being cheaper and keeping longer. He caused it therefore to be sifted, and put the finest flour into strong casks, and beat it close together with iron hammers, till it became so close a body that the air could scarcely penetrate it. This method was found to answer the purpose: and if, by it, the flour cannot be preserved as long as in dry and temperate climates, it may be kept for six months, a year, or longer, according to the degree of care taken in the preparation.

Caribbee ‖ Carica.

However troublesome these effects of the rain may be, it is attended with some others still more formidable; namely, frequent and dreadful earthquakes. These happening generally during the time or towards the end of the rainy season, and when the tides are highest, some ingenious naturalists have supposed that there might be connection between them. The waters of the sky and of the sea undermine, dig up, and ravage the earth in several different ways. Among the various shocks to which the Caribbee islands are exposed from the fury of the boisterous ocean, there is one distinguished by the name of *raz de maree*, or *whirlpool*. It constantly happens once, twice, or thrice from July to October, and always on the western coasts, because it takes place after the time of the westerly or southerly winds, or while they blow. The waves, which, at a distance seem to advance gently within 400 or 500 yards, suddenly swell against the shore, as if acted upon in an oblique direction by some superior force, and break with the greatest impetuosity. The ships which are then upon the coast, or in the roads beyond it, unable either to keep their anchors or to put out to sea, are dashed to pieces against the land, and all on board most commonly perish. The hurricane is another terrible phenomenon in these islands, by which incredible damage is occasioned; but happily it occurs not often.

The produce of the Caribbee islands is exceedingly valuable to the Europeans, consisting of sugar, rum, molasses, indigo, &c. a particular account of which is given under the names of the respective islands as they occur in the order of the alphabet.

CARIBBIANA, or Caribiana, the north east coast of Terra Firma, in South America, otherwise called *New Andalusia*.

CARICA, the papaw: A genus of the decandria order, belonging to the dioecia class of plants; and in the natural method ranking under the 38th order, *Tricoccæ*. The calyx of the male almost none; the corolla is quinquefid and funnel-shaped; the filaments in the tube of the corolla, a longer and shorter one alternately. The calyx of the female quinquedentated; the corolla is pentapetalous, with five stigmata; the fruit an unilocular and polyspermous berry.

*Species*. 1. The papaya rises with a thick, soft, herbaceous stem, to the height of 18 or 20 feet, naked till within two or three feet of the top. The leaves come out on every side, upon very long footstalks.

Those which are situated undermost are almost horizontal, but those on the top are erect: these leaves in full grown plants are very large, and divided into many lobs deeply sinuated. The stem of the plant, and also the footstalks of the leaves, are hollow. The flowers of the male plant are produced from between the leaves on the upper part of the plant. They have footstalks near two feet long; at the end of which the flowers stand in loose clusters, each having a separate short footstalk: these are of a pure white, and have an agreeable odour. The flowers of the female papaya also come out from between the leaves towards the upper part of the plant, upon very short footstalks, sitting close to the stem: they are large, and bell-shaped, composed of six petals, and are commonly yellow; when these fall away, the germen swells to a large fleshy fruit, of the size of a small melon. These fruits are of different forms: some angular, and compressed at both ends; others oval, or globular; and some pyramidal. The fruit, and all the other parts of the tree abound with a milky acrid juice, which is applied for killing of ring-worms. When the roundish fruit are nearly ripe, the inhabitants of India boil and eat them with their meat as we do turnips. They have somewhat the flavour of a pompion. Previous to boiling they soak them for some time in salt and water, to extract the corrosive juice; unless the meat they are to be boiled with should be very salt and old, and then this juice being in them will make it as tender as a chicken. But they mostly pickle the long fruit, and thus they make no bad succedaneum for mango. The buds of the female flowers are gathered, and made into a sweet-meat; and the inhabitants are such good managers of the produce of this tree, that they boil the shells of the ripe fruit into a repast, and the insides are eaten with sugar in the manner of melons.—The stem being hollow, has given birth to a proverb in the West-India islands; where, in speaking of a dissembling person, they say he is as hollow as a *Popo*.

2. The prosoposa, differs from the other in having a branching stalk, the lobes of the leaves entire, the flower of a rose colour, and the fruit shaped like a pear, and of a sweeter flavour than the papaya.

*Culture*, &c. These plants being natives of hot countries, cannot be preserved in Britain unless constantly kept in a warm stove, which should be of a proper height to contain them. They are easily propagated by seeds which are annually brought in plenty from the West-Indies, though the seeds of the European plants ripen well. The seeds should be sown in a hot-bed early in the spring: when the plants are near two inches high, they should be removed into separate small pots, and each plunged into a hot-bed of tanners bark, carefully shading them from the sun till they have taken root; after which, they are to be treated in the same manner as other tender exotics. When they are removed into other pots, care must be taken as much as possible to preserve the ball of earth about them, because wherever their roots are laid bare they seldom survive. When they are grown to a large size, they make a noble appearance with their strong upright stems, garnished on every side near the top with large shining leaves, spreading out near three feet all round the stem: the flowers of the male sort coming out in clusters on every side, and the fruit of the female growing round the stalks between the leaves, are so different from any thing of European production, as well to entitle these plants to a place in the gardens of the curious. The fruit of the first species is by the inhabitants of the Caribbee islands eaten with pepper and sugar as melons, but is much inferior to a melon in its native country; but those which have ripened in Britain were detestable: the only use to which Mr Miller says he has known them put was, when they were about half grown, to soak them in salt water to get out the acrid juice, and then pickle them for onangos, to which they are a good substitute.



CARICATURA, in painting, denotes the concealment of real beauties, and the exaggeration of blemishes, but still so as to preserve a resemblance of the object. The word is Italian; formed of *carica*, a load, burden, or the like.

CARICOUS, an epithet given to such tumours as resemble the figure of a fig. They are frequently found in the piles.

CARIES, the corruption or mortification of a bone. See MEDICINE and SURGERY, *Index*.

CARIGNAN, a fortified town of Piedmont, situated on the river Po, about seven miles south of Turin. E. Long. 7. 25. N. Lat. 44. 30. It was taken in 1544 by the French; who demolished the fortifications, but spared the castle. It was also taken, and retaken, in 1691.

CARILLONS, a species of chimes frequent in the low countries, particularly at Ghent and Antwerp, and played on a number of bells in a belfrey, forming a complete series or scale of tones and semitones, like those on the harpsichord and organ. There are petals communicating with the great bells, upon which the *carilloneur* with his feet plays the base to sprightly airs, performed with the two hands upon the upper species of keys. These keys are projecting sticks, wide enough asunder to be struck with violence and velocity by either of the hands edgeways, without the danger of hitting the neighbouring key. The player is provided with a thick leather covering for the little finger of each hand, to guard against the violence of the stroke. These carillons are heard through a large town.

CARINA, a Latin term, properly signifying the *keel* of a ship; or that long piece of timber running along the bottom of the ship from head to stern, upon which the whole structure is built or framed.

CARINA is also frequently used for the whole capacity or bulk of a ship; containing the hull or all the space below the deck. Hence the word is also sometimes used by a figure for the whole ship.

CARINA is also used in the ancient architecture. The Romans gave the name *carina* to all buildings in form of a ship, as we still give the name *nave* to the middle or principal vault of Gothic churches; because it has that figure.

CARINA, among anatomists, is used to denote the *spina dorsi*; as likewise for the fibrous rudiments or embryo of a chick appearing in an incubated egg. The carina consists of the entire *vertebræ*, as they appear after ten or twelve days incubation. It is thus called, because crooked in form of the keel of a ship—Botanists

nists also, for the like reason, use the word *carina*, to express the lower petalum of a papilionaceous flower.

CARINÆ were also weepers, or women hired among the ancient Romans to weep at funerals; they were thus called from *Caria*, the country whence most of them came.

CARINOLA, an episcopal town of Italy, in the kingdom of Naples, and Terra di Lavoro. E. Long. 15. 5. N. Lat. 41. 15.

CARINTHIA, a duchy of Germany, in the circle of Austria, bounded by the archbishopric of Saltzburg on the north, and by Carniola and the Venetian territories on the south, on the west by Tyrol, and on the east by Stiria. A part of this country was anciently called *Carnia*, and the inhabitants *Carni*; but the former afterwards obtained the name of *Carinthia*, and the latter *Carantani* or *Carinthi*. The air of this country is cold, and the soil in general mountainous and barren; but there are some fruitful dales and valleys in it, which produce wheat and other grain. The lakes, brooks, and rivers, which are very numerous, abound with fish, and the mountains yield lead and iron, and in many places are covered with woods. The river Drave, which runs across the country, is the most considerable in Carinthia. The inhabitants are partly descended of the ancient Germans, and partly of the Sclavonians or Wends. The states are constituted as in Austria, and their assemblies are held at Clagenfurt. The archbishop of Saltzburg, and the bishop of Bamberg, have considerable territories in this country. Christianity was planted here in the 7th century. The only profession tolerated at present is the Roman Catholic. The bishops are those of Gurk and Lavant, who are subject to the archbishop of Saltzburg. This duchy was formerly a part of Bavaria. In the year 1282, the emperor Rodolph I. gave it to Maynad count of Tyrol, on condition that when his male issue failed, it should revert to the house of Austria; which happened in 1331. Carinthia has its particular governor or *land-captain*, as he is called; and contributes annually towards the expence of the military establishment 637,695 florins. Only one regiment of foot is usually quartered in it.

CARIPI, a kind of cavalry in the Turkish army. The caripi, to the number of about 1000, are not slaves, nor bred up in the seraglio, like the rest; but are generally Moors or renegado Christians, who having followed adventures, being poor, and having their fortune to seek by their dexterity and courage, have arrived at the rank of horse-guards to the Grand Signior.

CARISSA, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 30th order, *Contortæ*. It has two many-seeded berries.

CARITAS.—The *poculum caritatis*, or grace-cup, was an extraordinary allowance of wine or other liquors, wherein the religious at festivals drank in commemoration of their founder and benefactors.

CARISBROOK-CASTLE, a castle situated in the middle of the isle of Wight, where king Charles I. was imprisoned. W. Long. 1. 30. N. Lat. 50. 40.

CARISTO, an episcopal city of Greece, in the eastern part of the island of Negropont, near Cape Loro. E. Long. 24. 15. N. Lat. 38. 6.



CARKE, denotes the 30th part of a SARPLAR of wool.

CARLE. See CHURL.

CARLETON, (Sir Dudley) was born in Oxfordshire, 1573, and bred in Christ-church college. He went as secretary to Sir Ralph Winwood into the Low Countries, when king James resigned the cautionary towns to the States; and was afterwards employed for 20 years as ambassador to Venice, Savoy, and the United Provinces. King Charles created him viscount Dorchester, and appointed him one of his principal secretaries of state; in which office he died in 1631. He was esteemed a good statesman, though an honest man; and published several political works.

CARLINA, the CARLINE THISTLE: A genus of the polygamia æqualis order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The calyx is radiated with long coloured marginal scales. There are seven species, only one of which is a native of Britain, viz. the vulgaris. The others are natives of the south of France or Italy; and are very easily propagated in Britain by seeds, which must be sown on a bed of fresh undunged earth, where they are to remain, as they do not bear transplanting. When the plants appear above ground, they should be carefully weeded, and afterwards thinned, leaving them about ten inches or a foot asunder. The second year most of them will flower; but, unless the season proves dry, they rarely produce good seeds in Britain, and some of the plants decay soon after they have flowered, so that it is pretty difficult to maintain them there. The roots are used in medicine, and for that purpose are imported from those countries where the plants grow naturally. As we receive them, they are about an inch thick, externally of a rusty brown colour, corroded, as it were on the surface, and perforated with numerous small holes appearing on the surface as if worm-eaten. They have a strong smell, and a subacrid, bitterish, weakly, aromatic taste. They are looked upon to be warm alexipharmics and diaphoretics. Frederic Hoffman the elder relates that he has observed a decoction of them in broth to occasion vomiting. They have been for some time greatly esteemed among foreign physicians; but never were much in use in Britain. The present practice has entirely rejected them, nor are they often to be met with in the shops.

CARLINE, or CAROLINE THISTLE. See CARLINA. It is said to have been discovered by an angel to Charlemagne, to cure his army of the plague; whence its denomination.

CARLINE, or *Caroline*, a silver coin current in the Neapolitan dominions, and worth about 8d. of our money.

CARLINES, or CARLINGS, in a ship, two pieces of timber lying fore and aft, along from one beam to another, directly over the keel; serving as a foundation for the whole body of the ship. On these the ledges rest, whereon the planks of the deck and other matters of carpentry are made fast. The carlines have their ends let into the beams called *culver-tail-wise*.

*CARLINE-Knees*, are timbers going athwart the ship,

 from

from the sides to the hatch-way, serving to sustain the deck on both sides.

CARLINGFORD, a port-town of Ireland, seated on Carlingford bay, in the county of Louth, and province of Leinster, 22 miles north of Drogheda. W. Long. 6. 24. N. Lat. 54. 5.

CARLISLE, the capital city of the county of Cumberland, seated on the south of the river Eden, and between the Petterel on the east, and the Caude on the west. It is surrounded by a strong stone-wall, and has a pretty large castle in the western part of it, as also a citadel in the eastern part, built by Henry VIII. It flourished in the time of the Romans, as appears from the antiquities that are to be met with here, and the Roman coins that have been dug up. At the departure of the Romans this city was ruined by the Scots and Picts; and was not rebuilt till the year 680, by Egfrid, who encompassed it with a wall, and repaired the church. In the 8th and 9th centuries, the whole country was again ruined, and the city laid desolate by the incursions of the Norwegians and Danes. In this condition it remained till the time of William Rufus; who repaired the walls and the castle, and caused the houses to be rebuilt. It was fortified by Henry I. as a barrier against Scotland; he also placed a garrison in it, and made it an episcopal see. It was twice taken by the Scots, and afterwards burnt accidentally in the reign of Richard II. The cathedral, the suburbs, and 1500 houses, were destroyed at that time. It is at present in a good condition; and has three gates, the English on the south, the Scotch on the north, and the Irish on the west. It has two parishes, and as many churches, St Cuthbert and St Mary's, the last of which is the cathedral, and is separated from the town by a wall of its own. The eastern part, which is the newest, is a curious piece of workmanship. The choir with the aisles is 71 feet broad; and has a stately east window 48 feet high and 30 broad, adorned with curious pillars. The roof is elegantly vaulted with wood; and is embellished with the arms of England and France quartered; as also with Piercy's, Lucy's, Warren's, Moubray's, and many others. In the choir are the monuments of three bishops who are buried there. The see was erected in 1133 by king Henry I. and made suffragan to the archbishop of York. The cathedral church here had been founded a short time before by Walter, deputy in these parts for king William Rufus, and by him dedicated to the Virgin Mary. He likewise built a monastery, and filled it with canons regular of St Augustine. This foundation continued till the dissolution of monasteries, when its lands were added to the see, and the maintenance of a dean, &c. placed here in their room. The church was almost ruined by the usurper Cromwell and his soldiers; and has never since recovered its former beauty, although repaired after the restoration. This diocese contains the greatest part of the counties of Cumberland and Westmoreland, in which are only 93 parishes; but these (as all the northern are) exceeding large; and of them are 18 impropriations. Here is one archdeacon, *viz.* of Carlisle. The see is valued in the king's books at L. 530 : 4 : 11½, but is computed to be worth annually L. 2800. The clergy's tenth amounts only to L. 161 : 1 : 7½. To this cathedral belong a bishop, a dean, a chancellor, an archdeacon, four prebendaries, eight minor canons, &c. and other inferior officers and servants.



The Picts wall, which was built across the country from Newcastle, terminates near this place. Carlisle was a fortified place, and still has its governor and lieutenant-governor, but no garrison. It was taken by the rebels Nov. 15, 1745; and was retaken by the duke of Cumberland on the 10th of December following, and deprived of its gates. It is governed by a mayor, twelve aldermen, two bailiffs, &c. and has a considerable market on Saturdays. The manufactures of Carlisle are chiefly of printed linens, for which near 3000 l. per annum is paid in duties. It is also noted for a great manufacture of whips, in which a great number of children are employed.—Salmons appear in the Eden in numbers, so early as the months of December and January; and the London and even Newcastle markets are supplied with early fish from this river; but it is remarkable, that they do not visit the Esk in any quantity till April; notwithstanding the mouths of the two rivers are at a small distance from each other.—Carlisle sends two members to parliament, and gives title of Earl to a branch of the Howard family.

CARLOCK, in commerce, a sort of isinglass, made with the sturgeon's bladder, imported from Archangel. The chief use of it is for clarifying wine, but it is also used by the dyers. The best carlock comes from Astracan, where a great quantity of sturgeon is caught.

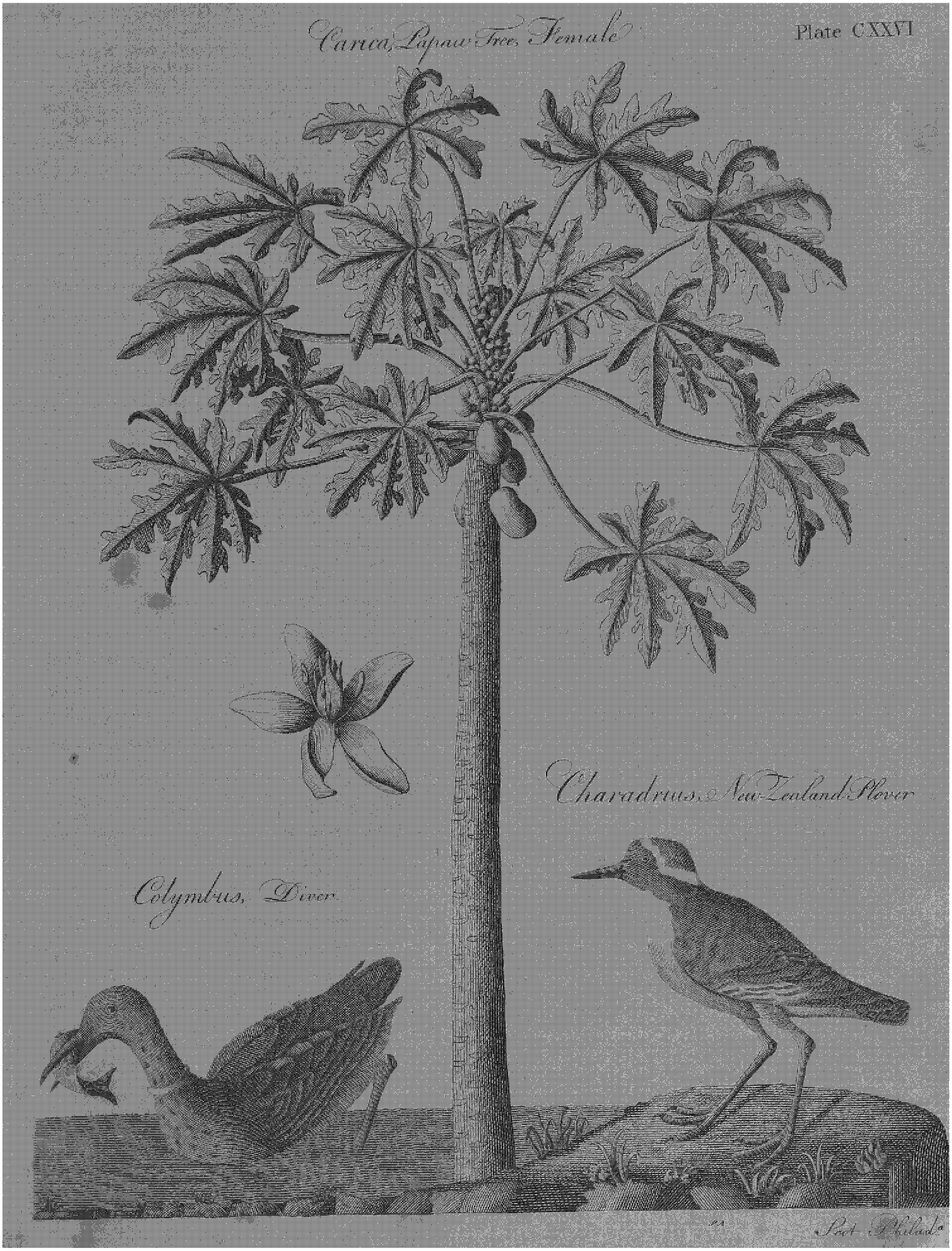
CARLOSTAD, or CARLSTAD, a town of Sweden, in Wermeland, seated on the lake Warmer, in E. Lon. 14. 4. N. Lat. 59. 16.

CARLOSTAD, or *Carlstadt*, a town of Hungary, capital of Croatia, and the usual residence of the governors of the province. It is seated on the river Kulph, in E. Long. 16. 5. N. Lat. 45. 34.

CARLOWITZ, a small town of Hungary, in Sclavonia, remarkable for a peace concluded here between the Turks and Christians, in 1669. It is seated on the west side of the Danube, in E. Long. 19. 5. N. Lat. 45. 25.

CARLSCRONA, or CARLSCROON, a sea-port town in the Baltic, belonging to Sweden. It derives its origin and name from Charles XI. who first laid the foundations of a new town in 1680, and removed the fleet from Stockholm to this place, on account of its advantageous situation in the centre of the Swedish seas, and the superior security of its harbour. The greatest part of Carlscrona stands upon a small rocky island, which rises gently in a bay of the Baltic; the suburbs extend over another small rock, and along the mole close to the bason where the fleet is moored. The way into the town from the main land is carried over a dyke to an island, and from thence along two long wooden bridges joined by a barren rock. The town is spacious, and contains about 18,000 inhabitants. It is adorned with one or two handsome churches, and a few tolerable houses of brick; but the generality of buildings are of wood. The suburbs are fortified towards the land by a stone-wall. The entrance into the harbour, which by nature is extremely difficult from a number of shoals and rocky islands, is still further secured from the attack of an enemy's fleet by two strong forts built on two islands, under the batteries of which all vessels must pass.

Formerly


Carica, Papaw Tree, Female
Plate CXXVI
Charadrius, New Zealand Plover
Colymbus, Diver
Scot Philadª

Formerly vessels in this port, when careened and repaired, were laid upon their sides in the open harbour, until a dock, according to a plan given by Polheim, was hollowed in the solid rock: it was begun in 1714, and finished in 1724; but as it was too small for the admission of men of war, it has lately been enlarged, and is now capable of receiving a ship of the first rate. But new docks have been begun upon a stupenduous plan worthy of the ancient Romans. According to the original scheme, it was intended to construct 30 docks, for building and laying up the largest ships, at the extremity of the harbour. A large bason, capable of admitting two men of war, is design to communicate, by sluices, with two smaller basons, from each of which are to extend, like the radii of a circle, five rows of covered docks: each row is to be separted by walls of stones; and each dock to be provided with sluice-gates, so as to be filled or emptied by means of pumps. Close to the docks, magazines for naval stores are to be constructed, and the whole to be inclosed with a stone-wall. The project was begun in 1757; but was much neglected until the accession of his present majesty, who warmly patronized the arduous undertaking. At the commencement of the works, L. 25,000 were annually expended upon them; which sum has been lessened to about L. 6000 per annum, and the number of docks reduced to 20. The first dock was finished in 1779, and it was computed that the whole number would be executed in 20 years.

CARLSTADT, a town of Germany, in the circle of Franconia, and bishopric of Wurtsburg, seated on the river Maine, in E. Long. 9. 51. N. Lat. 50. 0.

CARLTON, a town in Norfolk held by this tenure, that they shall present 1000 herrings baked in 14 pies to the king, wherever he shall be when they first come in season,

CARMAGNIOLA, a fortified town of Italy, in Piedmont, with a good castle. It was taken by the French in 1591, and retaken by prince Eugene the same year. It is seated in a country abounding in corn, flax, and silk, near the river Po, in E. Long. 7. 32. N. Lat. 44 43.

CARMANIA, (anc. geog.) a country of Asia, to the east of Persia, having Parthia to the north, Gedrosia to the east, to the south the Persian Gulf or Sea in part, and in part the Indian, called the *Carmanian Sea*, distinguished into *Carmania Deserta* and *Carmania Propria*; the former lying to the south of Parthia: and to the south of that, the *Propria*, quite to the sea. Its name is from the Syriac, *Carma*, signifying a "vine," for which that country was famous, yielding clusters three feet long. Now KERMAN, or CARIMANIA, a province of modern Persia.

CARMEL, a high mountain of Palestine, standing on the skirts of the sea, and forming the most remarkable head-land on all that coast. It extends eastward from the sea as far as the plain of Jezreel, and from the city of that name quite to Cæsarea on the south. It seems to have had the name of *Carmel* from its great fertility; this word, according to the Hebrew import, signifying the *vine of God*, and is used in scripture to denote any fruitful spot, or any place planted with fruit trees. This mountain, we are assured, was very fertile. Mr Sandys acquaints us, that when well cultivated, it abounds with olives, vines, and variety of fruits and herbs both medical and aromatic. Others, however, represent it as rather dry and barren; which perhaps may have happened from the neglect of agriculture so common in all parts of the Turkish empire, especially where they are exposed to the incursions of the Arabs. Carmel is the name of the mountain, and of a city built on it; as well as of a heathen deity worshiped in it, but without either temple or statue: though anciently there must have been a temple, as we are told that this mountain was a favourite retreat of Pythagoras, who spent a good deal of time in the temple, without any person with him. But what hath rendered mount Carmel most celebrated and revered both by Jews and Christians, is its having been the residence of the prophet Elijah, who is supposed to have lived there in a cave (which is there shewn), before he was taken up into heaven.



CARMELITES, an order of religious, making one of the four tribes of mendicants or begging friars; and taking its name from mount Carmel, formerly inhabited by Elias, Elisha, and the children of the prophets; from whom this order pretends to descend in an uninterrupted succession. The manner in which they make out their antiquity has something in it too ridiculous to be rehearsed. Some among them pretend they are descendants of Jesus Christ; others go further, and make Pythagoras a Carmelite, and the ancient druids regular branches of their order. Phocas a Greek monk, speaks the most reasonably. He says, that in his time, 1185, Elias's cave was still extent on the mountain; near which was the remains of a building which intimated that there had been anciently a monastery; that, some years before, an old monk, a priest of Calabria, by revelation, as he pretended, from the prophet Elias, fixed there, and assembled ten brothers.—In 1209, Albert, patriarch of Jerusalem, gave the solitaries a rigid rule, which Papebroch has since printed. In 1217, or, according to others, 1226, pope Honorius III. approved and confirmed it. This rule contained 16 articles; one of which confirmed them to their cells, and enjoined them to continue day and night in prayers; another prohibited the brethren having any property; another enjoined fasting from the feast of the holy cross till Easter, except on Sundays; abstinence at all times from flesh was enjoined by another article; one obliged them to manual labour; another imposed a strict silence on them from vespers till the tierce the next day.

The peace concluded by the emperor Frederic II. with the Saracens, in the year 1229, so disadvantageous to Christendom, and so beneficial to the infidels, occasioned the Carmelites to quit the Holy Land, under Alan the fifth general of the order. He first sent some of the religious to Cyprus, who landed there in the year 1238, and founded a monastery in the forest of Fortania. Some Sicilians, at the same time, leaving mount Carmel, returned to their own country, where they founded a monastery in the suburbs of Messina. Some English departed out of Syria, in the year 1240, to found others in England. Others of Provence, in the year 1244, founded a monastery in the desart of Aigualates, a league from Marseilles: and thus, the number of their monasteries increasing, they held their European general chapter in the year 1245, at their monastery

nastery of Aylesford in England.—This order is so much increased, that it has, at present, 38 provinces, besides the congregation of Mantua, in which are 54 monasteries, under a vicar-general, and the congregations of Barefooted Carmelites in Italy and Spain, which have their peculiar generals.

After the establishment of the Carmelites in Europe, their rule was in some respects altered; the first time, by pope Innocent IV. who added to the first article a precept of chastity, and relaxed the 11th which enjoins abstinence at all times from flesh, permitting them, when they travelled, to eat boiled flesh: this pope likewise gave them leave to eat in a common refectory, and to keep asses or mules for their use. Their rule was again mitigated by the popes Eugenius IV. and Pius II. Hence the order is divided into two branches, viz. *the Carmelites of the ancient observance*, called the *moderate* or *mitigated;* and those *of the strict observance*, who are the *barefooted Carmelites;* a reform set on foot in 1540, by S. Theresa, a nun of the convent of Avila, in Castile: these last are divided into two congregations, that of Spain and that of Italy.

The habit of the Carmelites was at first white, and the cloak laced at the bottom with several lists. But pope Honorious IV. commanded them to change it for that of the Minims. Their scapulary is a small woollen habit of a brown colour, thrown over their shoulders. They wear no linen shirts; but instead of them linsey-wolsey, which they change twice a-week in the summer and once a week in the winter.

If a monk of this order lies with a woman, he is prohibited saying mass for three or four years, is declared infamous, and obliged to discipline himself publicly once a-week. If he is again guilty of the same fault, his penance is doubled; and if a third time, he is expelled the order.

CARMEN, an ancient term among the Latins, used in a general sense to signify a verse; but more particularly to signify a spell, charm, form of expiation or execration, couched in a few words placed in a mystic order, on which its efficacy depended. Pezron derives the word *carmen* from the Celtic *carm*, the shout of joy, or the verses which the ancient bards sung to encourage the soldiers before the combat.—*Carmen* was anciently a denomination given also to precepts, laws, prayers, imprecations, and all solemn formulæ couched in a few words placed in a certain order, though written in prose. In which sense it was that the elder Cato wrote a *Carmen de moribus*, which was not in verse, but in prose.

CARMENTALIA, a feast among the ancient Romans celebrated annually upon the 11th of January, in honour of Carmenta, or Carmentis, a prophetess of Arcadia, mother of Evander, with whom she came into Italy 60 years before the Trojan war. The solemnity was also repeated on the 15th of January, which is marked in the old calendar by *Carmentalia relata*. This feast was established on occasion of a great fecundity among the Roman dames, after a general reconciliation with their husbands, with whom they had been at variance, in regard of the use of coaches being prohibited them by an edict of the senate. This feast was celebrated by the women: he who offered the sacrifices was called *sacerdos carmentalis*.

CARMINATIVES, medicines used in colics, or other flatulent disorders, to dispel the wind.



The word comes from the Latin *carminare*, to card or teaze wool, and figuratively to attenuate and discuss wind or vapours, and promote their discharge by perspiration. Though Dr Quincy makes it more mysterious: He says it comes from the word *carmen*, taking it in the sense of an invocation or charm; and makes it to have been a general name for all medicines which operated like charms, *i. e.* in an extraordinary manner. Hence, as the most violent pains were frequently those arising from pent-up wind, which immediately cease upon dispersion; the term *carminative* became in a peculiar sense applied to medicines which gave relief in windy cases, as if they cured by inchantment: but this interpretation seems a little too far strained.

CARMINE, a powder of a very beautiful red colour, bordering upon purple; and used by painters in miniature, though rarely on account of its great price. The manner of preparing it is kept a secret by the colour-makers; neither do any of those receipts which have for a long time been published concerning the preparation of this and other colours at all answer the purpose. See *Colour-Making*.

CARMONA, a town of Italy in Frioli, and in the county of Goritz, seated on a mountain near the river Indri. It belongs to the house of Austria. E. Long. 5. 37. N. Lat. 46. 15.

Carmona, an ancient town of Spain in Andalusia. The gate towards Seville is one of the most extraordinary pieces of antiquity in all Spain. It is seated in a fertile country, 15 miles east of Seville. W. Long. 5. 37. N. Lat. 37. 24.

CARNATION, in botany. See Dianthus.

*Carnation-Colour*, among painters, is understood of all the parts of a picture, in general, which represent flesh, or which are naked and without drapery. Titian and Corregio in Italy, and Rubens and Vandyke in Flanders, excelled in carnations.—In colouring for flesh, there is so great a variety, that it is hard to lay down any general rules for instruction therein; neither are there any regarded by those who have acquired a skill this way: the various colouring for carnations may be easily produced, by taking more or less red, blue, yellog or bistre, whether for the first colouring, or for the finishing the colouring for women should be bluish, for children a little red, both fresh and gay; and for the men it should incline to yellow, especially if they are old.

Carnation, among dyers. To dye a carnation, or red rose colour, it is directed to take liquor of wheat bran a sufficient quantity, alum three pounds, tartar two ounces; boil them and enter twenty yards of broad cloth; after it has boiled three hours, cool and wash it: take fresh clear bran liquor a sufficient quantity, madder five pounds; boil and sodden according to art.—The Bow dyers know that the solution of jupiter, or delved tin, being put in a kettle to the alum and tartar, in another process, make the cloth, &c. attract the colour into it, so that none of the cochineal is left, but the whole is absorbed by the cloth.

CARNEADES, a celebrated Greek Philosopher, was a native of Cyrene in Africa, and founder of the third academy. He was so fond of study, that he not only avoided all entertainments, but forgot even to eat at his own table; his maid-servant Melissa was obliged to put the victuals into his hand. He was an antagonist of the Stoics; and applied himself with great eagerness gernefs to refute the works of Chryfippus, one of the moft celebrated philofophers of their fect. The power of his eloquence was dreaded even by a Roman fenate. The Athenians being condemned by the Romans to pay a fine of 500 talents for plundering the city of Oropus, fent ambaffadors to Rome, who got the fine mitigated to 100 talents. Carneades the academic, Diogenes the Stoic, and Critolaus the Peripatetic, were charged with this embaffy. Before they had an audience of the fenate, they harangued to great multitudes in different parts of the city. Carneades's eloquence was diftinguifhed from that of the others by its ftrength and rapidity. Cato the elder made a motion in the fenate, that thefe ambaffadors fhould be immediately fent back, becaufe it was very difficult to difcern the truth thro' the arguments of Carneades. The Athenian ambaffadors (faid many of the fenators) were fent rather to force us to comply with their demands, than to folicit them by perfuafion; meaning, that it was impoffible to refift the power of that eloquence with which Carneades addreffed himfelf to them. According to Plutarch, the youth at Rome were fo charmed by the fine orations of this philofopher, that they forfook their exercifes and other diverfions, and were carried with a kind of madnefs to philofophy; the humour of philofophifing fpreading like enthufiafm. This grieved Cato, who was particularly afraid of the fubtilty of wit and ftrength of argument with which Carneades maintained either fide of a queftion. Carneades harangued in favour of juftice one day, and the next day againft it, to the admiration of all who heard him, among whom were Galba and Cato, the greateft orators of Rome. This was his element; he delighted in demolifhing his own work; becaufe it ferved in the end to confirm his grand principle, that there are only probabilities or refemblances of truth in the mind of man; fo that of two things directly oppofite, either may be chofen indifferently. Quintilian remarks, that though Carneades argued in favour of injuftice, yet he himfelf acted according to the ftrict rules of juftice. The following was a maxim of Carneades: "If a man privately knew that his enemy, or any other perfon whofe death might be of advantage to him, would come to fit down on grafs in which there lurked an afp, he ought to give him notice of it, though it were in the power of no perfon whatever to blame him for being filent." Carneades, according to fome, lived to be 85 years old; others make him to be 90: his death is placed in the 4th year of the 162d Olympiad.

CARNEDDE, in Britifh antiquity, denotes heaps of ftones fuppofed to be druidical remains, and thrown together on occafion of confirming and commemorating a covenant. Gen. xxxi. 46. They are very common in the ifle of Anglefey, and were alfo ufed as fepulchral monuments, in the manner of *tumuli;* for Mr Rowland found a curious urn in one of thefe carnedde. Whence it may be inferred, that the Britons had the cuftom of throwing ftones on the deceafed. From this cuftom is derived the Welch proverb, *Karn ardyben*, "ill betide thee."

CARNEIA, in antiquity, a feftival in honour of Apollo, furnamed Carneus, held in moft cities of Greece, but efpecially at Sparta, where it was firft inftituted.

The reafon of the name, as well as the occafion of the inftitution, is controverted. It lafted nine days, beginning on the 13th of the month Carneus. The ceremonies were an imitation of the method of living and difcipline ufed in camps.



CARNEL.—The building of fhips firft with their timber and beams, and after bringing on their planks, is called *carnel-work*, to diftinguifh it from clinchwork.

Veffels alfo which go with mizzen-fails inftead of main-fails are by fome called carnels.

CARNELIAN, in natural hiftory, a precious ftone, of which there are three kinds, diftinguifhed by three colours, a red, a yellow, and a white. The red is very well known among us; is found in roundifh or oval maffes, much like our common pebbles; and is generally met with between an inch and two or three inches in diameter: it is of a fine, compact, and clofe texture; of a gloffy furface; and, in the feveral fpecimens, is of all the degrees of red, from the paleft flefh-colour to the deepeft blood-red. It is generally free from fpots, clouds, or variegations: but fometimes it is veined very beautifully with an extremely pale red, or with white; the veins forming concentric circles, or other lefs regular figures, about a nucleus, in the manner of thofe of agates. The pieces of carnelian which are all of one colour, and perfectly free from veins, are thofe which our jewellers generally make ufe of for feals, though the variegated ones are much more beautiful. The carnelian is tolerably hard, and capable of a very good polifh: it is not at all affected by acid menftruums: the fire divefts it of a part of its colour, and leaves it of a pale red; and a ftrong and long continued heat will reduce it to a pale dirty gray.

The fineft carnelians are thofe of the Eaft Indies; but there are very beautiful ones found in the rivers of Silefia and Bohemia; and there are fome not defpicable ones in England.

Though the ancients have recommended the carnelian as aftringent, and attributed a number of fanciful virtues to it, we know of no other ufe of the ftone than the cutting feals on it; to which purpofe it is excellently adapted, as being not too hard for cutting, and yet hard enough not to be liable to accidents, to take a good polifh, and to feparate eafily from the wax.

CARNERO, in geography, a name given to that part of the gulph of Venice which extends from the weftern coaft of Iftria to the ifland of Groffa and the coaft of Morlachia.

CARNERO is likewife the name of the cape to the weft of the mouth of the bay of Gibraltar.

CARNIFEX, among the Romans, the common executioner. By reafon of the odioufnefs of his office, the carnifex was exprefsly prohibited by the laws from having his dwelling-houfe within the city. In middle age writers carnifex alfo denotes a butcher.

Under the Anglo-Danifh kings, the carnifex was an officer of great dignity; being ranked with the archbifhop of York, earl Goodwin, and the lord fteward. Flor. Wigorn. ann. 1040. *Rex Hardecanutus Alfricum Ebor. Archiep. Goodwinum comitem, Edricum difpenfatorem, Thrond fuum* carnificem, & *alios magnæ dignitatis viros Londinum mifit.*

CARNIOLA, a duchy of Germany bounded on the fouth by the Adriatic fea, and that part of Iftria

Carniola, Carnival.

possessed by the republic of Venice; on the north, by Carinthia and Stiria; on the east, by Sclavonia and Croatia; on the west, by Friuli, the county of Gorz or Goritz, and a part of the gulph of Venice; extending in length about 110 miles, and in breadth about 50. It had its ancient name *Carnia*, as well as the modern one *Carniola*, from its ancient inhabitants the *Carni*, a tribe of Scythians, otherwise called *Japides*, whence this and the adjacent countries were also called *Japidia*.

Carniola is full of mountains, some of which are cultivated and inhabited, some covered with wood, others naked and barren, and others continually buried in snow. The valleys are very fruitful. Here are likewise mines of iron, lead and copper; but salt must be had from the sovereign's magazines. There are several rivers, besides many medicinal springs and inland lakes. The common people are very hardy, going barefooted in winter through the snow, with open breasts, and sleeping on a hard bench without bed or bolster. Their food is also very coarse and mean. In winter, when the snow lies deep on the ground, the mountaineers bind either small baskets, or long thin narrow boards, like the Laplanders, to their feet, on which, with the help of a stout staff or pole, they descend with great velocity from the mountains. When the snow is frozen, they make use of a sort of irons or skaits. In different parts of the country the inhabitants, especially the common sort, differ greatly in their dress, language, and manner of living. In Upper and Lower Carniola they wear long beards. The languages chiefly in use are the Sclavonian or Wendish, and German; the first by the commonalty, and the latter by people of fashion. The duchy is divided into the Upper, Lower, Middle, and Inner, Carniola. The principal commodities exported hence are, iron, steel, lead, quicksilver, white and red wine, oil of olives, cattle, sheep, cheese, linen, and a kind of woollen stuff called *mahalan*, Spanish leather, honey, walnuts, and timber; together with all manner of wood-work, as boxes, dishes, &c.—Christianity was first planted here in the eight century.—Lutheranism made a considerable progress in it; but, excepting the Walachians or Uskokes, who are of the Greek church, and style themselves *Staraverzi*, i. e. old believers, all the inhabitants at present are Roman Catholics. Carniola was long a marquisate or margravate; but in the year 1231 was erected into a duchy. As its proportion towards the maintenance of the army, it pays annually 363,171 florins; but only two regiments of foot are quartered in it.

CARNIVAL, or CARNAVAL, a time of rejoicing, a season of mirth, observed with great solemnity by the Italians, particularly at Venice, holding from the twelfth day till Lent.

The word is formed from the Italian *Carnavalle*; which Mr Du-Cange derives from *Carn-a-val*, by reason the flesh then goes to pot, to make amends for the season of abstinence then ensuing. Accordingly, in the corrupt Latin, he observes, it was called *Carnelevamen*, and *Carnisprivium*; as the Spaniards still denominate it *carnes tollendas*.

Feasts, balls, operas, concerts of music, intrigues, marriages, &c. are chiefly held in carnival time. The carnival begins at Venice the second holiday in Christmas: Then it is they begin to wear masks, and open their play-houses and gaming houses; the place of St Mark is filled with mountebanks, jack-puddings, pedlars, whores, and such like mob, who flock thither from all parts. There have been no less than seven sovereign princes and 30,000 foreigners here to partake of these diversions.

Carnivorous, Carnosity.

CARNIVOROUS, an epithet applied to those animals which naturally seek and feed on flesh.

It has been a dispute among naturalists, whether man is naturally carnivorous. Those who take the negative side of the question, insist chiefly on the structure of our teeth, which are mostly incisores or molares; not such as *carnivorus* animals are furnished with, and which are proper to tear flesh in pieces: to which it may be added, that, even when we do feed on flesh, it is not without a preparatory alteration by boiling, roasting, &c. and even then that it is the hardest of digestion of all foods. To these arguments Dr Wallis subjoins another, which is that all quadrupeds which feed on herbs or plants have a long colon, with a cœcum at the upper end of it, or somewhat equivalent, which conveys the food by a long and large progress, from the stomach downwards, in order to its slower passage and longer stay in the intestines; but that, in *carnivorus* animals, such cœcum is wanting, and instead thereof there is a more short and slender gut, and a quicker passage through the intestines. Now, in man, the cœcum is very visible: a strong presumption that nature, who is still consistent with herself, did not intend him for a *carnivorous* animal.—It is true, the cœcum is but small in adults, and seems of little or no use; but in a fœtus it is much larger in proportion: And it is probable, our customary change of diet, as we grow up, may occasion this shrinking. But to these arguments, Dr Tyson replies, that if man had been by nature designed not to be *carnivorous*, there would doubtless have been found, somewhere on the globe, people who do not feed on flesh; which is not the case. Neither are carnivorous animals always without a colon and cœcum; nor are all animals carnivorous which have these parts: the opossum, for instance, hath both a colon and cœcum, and yet feeds on poultry and other flesh; whereas the hedge-hog, which has neither colon nor cœcum, and so ought to be carnivorous, feeds only on vegetables. Add to this, that hogs, which have both, will feed upon flesh when they can get it; and rats and mice, which have large cœcums, will feed on bacon as well as bread and cheese. Lastly, the human race are furnished with teeth necessary for the preparation of all kinds of foods; from whence it would seem, that nature intended we should live on all. And as the alimentary duct in the human body is fitted for digesting all kinds of food, ought we not rather to conclude, that nature did not intend to deny us any?

It is no less disputed whether mankind were *carnivorous* before the flood. St Jerom, Chrysostom, Theodoret, and other ancients, maintain, that all animal food was then forbidden; which opinion is also strenuously supported among the moderns by Curcellæus, and refuted by Heidegger, Danzius, Bockhart, &c. See ANTEDILUVIANS.

CARNOSITY is used by some authors for a little fleshy

Caro, Carolina.

fleshy excrescence, tubercle, or wen, formed in the urethra, the neck of the bladder, or yard, which stops the passage of the urine.—Carnosities are very difficult of cure: they are not easily known but by introducing a probe into the passage, which there meets with resistance. They usually arise from some venereal malady ill managed.

CARO, (Annibal) a celebrated Italian poet, was born at Civita Nuovo in 1507. He became secretary to the Duke of Parma, and afterwards to Cardinal Farnese. He was also made a knight of Malta. He translated Virgil's Æneid into his own language with such propriety and elegance of expression, that he was allowed by the best judges to have equalled the original. He also translated Aristotle's rhetoric, two oratorios of Gregory Nazianzen, with a discourse of Cyprian. He wrote a comedy; and a miscellany of his poems was printed at Venice in 1584. He died at Rome in 1566.

CAROLINA, (North and South) two of the United States of North America, lying betwen 32° and 36°, 30 N. Lat. and 76° and 91° W. Long. Bounded on the east by the Atlantic, on the west by the river Mississippi, on the north by Virginia, and on the south by Georgia and Florida.

This country is seated between the extremities of heat and cold, though the heat is more troublesome in summer than the cold in winter; their winters being very short, and the frosty mornings frequently succeeded by warm days. The air is generally serene and clear the greatest part of the year; but in February and March the inhabitants have a custom of burning the woods, which causes such a smoke as to strangers would seem to proceed from a fog or thickness in the air. The smoke of the tar-kilns likewise deceives strangers, and gives them an ill opinion of the air of Carolina; to which also conduces a custom of the Indians of setting fire to the woods in their huntings, for many miles round. The great rains are in winter, though they are not without heavy showers at midsummer; add to these the constant dews that fall in the night, which refresh the ground and supply the plants with moisture. In North Carolina, the northwest winds in the winter occasion very pinching weather; but they are not of long continuance. Westerly winds bring very pleasant weather; but the southerly are hot and unwholesome, occasioning fevers and other disorders. But this must be understood of summer, for in winter they are very comfortable. The depth of winter is towards the latter end of February, and then the ice is not strong enough to bear a man's weight. In August and September there are sometimes great storms and squalls of wind, which are so violent as to make lanes of 100 feet wide, more or less, thro' the woods, tearing up the trees by the roots. These storms generally happen once in about seven years; and are attended with dreadful thunder, lightning, and heavy rains. They commonly happen about the time of the hurricanes which rage so fatally among the islands between the tropics; and seem to be occasioned by them, or to proceed from the same cause: but by the time they reach Carolina, their force is much abated; and the farther north they proceed, so much the more do they decrease in fury. The soil on the coast is sandy; but farther up, the country is so fruitful that they have not yet been at the trouble to manure their land. The grains most cultivated are Indian corn and rice, though any sort will thrive well enough; they have also pulse of several sorts, little known in England. All kinds of garden stuff usual in England are cultivated here, and may be had in great plenty. They export large quantities yearly of rice, pitch, tar, turpentine, deer-skins, and timber for building; cypress, cedar, sassafras, oak, walnut, and pine. Besides these they also send out beef, pork, tallow, hides, furs, wheat, peas, potatoes, honey, bees-wax, myrtle-wax, tobacco, snake-root, cotton, several sorts of gums and medicinal drugs. Indigo is also cultivated in this country, but of an inferior quality to that which is raised in the Caribbee islands. The culture of vines in this country has made but little progress, from the idea that the frosts, though not of long continuance, are yet sufficient to check the growth of the vine, as well as olives, dates, oranges, &c. but as population increases these articles will become of much importance. The furs are bought of the Indians with vermilion, lead, gunpowder, coarse cloth, iron, and spirituous liquors. The aspect of the country is very fine, being adorned with beautiful rivers and creeks, and the woods with lofty timber, which afford delightful and pleasant seats for the planters, and render the fencing their lands very easy. And as they have plenty of fish, wild fowl, and venison, besides other necessaries which this country produces naturally, they live easy and luxuriously.

Carolina was discovered by Sebastian Cabot, about the year 1500, in the reign of Henry VII. but the settling of it being neglected by the English, a colony of French Protestants, by the encouragement of Admiral Coligni, were transported thither; and named the place of their first settlement *Arx Carolina*, in honour of their prince, Charles IX. of France: but in a short time that colony was destroyed by the Spaniards; and no other attempt was made by any European power to settle there till the year 1664, when 800 English landed at Cape-Fear in North Carolina, and took possession of the country. In 1670 Charles II. of Britain granted Carolina to the Lords Berkley, Clarendon, Albemarle, Craven, and Ashley, Sir George Carteret, Sir William Berkley, and Sir John Colliton. The plan of government for this new colony was drawn up by the famous Mr Locke, who very wisely proposed an universal toleration in religious matters. The only restriction in this respect was, that every person claiming the protection of that settlement, should, at the age of 17, register himself in some particular communion. To civil liberty, however, our philosopher was not so favourable; the code of Carolina gave to the eight proprietors who founded the colony, and to their heirs, not only all the rights of a monarch, but all the powers of a legislation. The court, which was composed of this sovereign body, and called the *Palatine Court*, was invested with the right of nominating to all employments and dignities, and even of conferring nobility; but with new and unprecedented titles. They were, for instance, to create in each county two *caciques*, each of whom was to be possessed of 24,000 acres of land; and a *landgrave*; who was to have 80,000. The persons on whom these honours should be bestowed were to compose the upper house, and their possessions were made unalienable. They had only the right of farming or letting out a third part of them

them at the moſt for three lives. The lower houſe was compoſed of the deputies from the ſeveral counties and towns. The number of this repreſentative body was to be increaſed as the colony grew more populous. No tenant was to pay more than about a ſhilling per acre, and even this rent was redeemable. All the inhabitants, however, both ſlaves and freemen, were under an obligation to take up arms upon the firſt order from the Palatine court.

It was not long before the defects of this conſtitution became apparent. The proprietary lords uſed every endeavour to eſtabliſh an arbitrary government; and, on the other hand, the coloniſts exerted themſelves with great zeal to avoid ſervitude. In conſequence of this ſtruggle, the whole province, diſtracted with tumults and diſſentions, became incapable of making any progreſs, though great things had been expected from its particular advantages of ſituation. Tho' a toleration in religious matters was a part of the original conſtitution, diſſentions aroſe likewiſe on that account. In 1705, Carteret, now Lord Granville, who, as the oldeſt of the proprietors, was ſole governor of the colony, formed a deſign of obliging all the non-conformiſts to embrace the ceremonies of the Church of England; and this act of violence, though diſavowed and rejected by the mother-country, inflamed the minds of the people. In the year 1712, a dangerous conſpiracy was formed by the Coree and Tuſcorora tribes of Indians, to murder and expel this infant colony. The foundation for this conſpiracy is not known. Probably they were offended at the encroachments upon their hunting ground. They managed their conſpiracy with great cunning and profound ſecrecy. They ſurrounded their principal town with a breaſt-work to ſecure their families. Here the warriors convened to the number of 1200. From this place of rendezvous they ſent out ſmall parties, by different roads, who entered the ſettlement under the maſk of friendſhip. At the change of the full moon, all of them had agreed to begin their murderous operations the ſame night. When the night came, they entered the houſes of the planters, demanding proviſions, and pretending to be offended, fell to murdering men, women and children without mercy or diſtinction. One hundred and thirty-ſeven ſettlers, among whom were a Swiſs baron, and almoſt all the poor Palatines that had lately come into the country, were ſlaughtered the firſt night. Such was the ſecrecy and diſpatch of the Indians in this expedition, that none knew what had befallen his neighbour, until the barbarians had reached his own door. Some few, however, eſcaped and gave the alarm.—The militia aſſembled in arms, and kept watch day and night, until the news of the ſad diſaſter had reached the province of South Carolina. Governor Craven loſt no time in ſending a force to their relief.—The aſſembly voted £. 4000 for the ſervice of the war. A body of 600 militia, under the command of colonel Barnwell, and 366 Indians of different tribes, with different commanders, marched with great expedition, through a hideous wilderneſs, to their aſſiſtance. In their firſt encounter with the Indians, they killed 300 and took 100 priſoners. After this defeat the Tuſcororas retreated to their fortified town—which was ſhortly after ſurrendered to colonel Barnwell. In this whole expedition it was computed that near a thouſand Tuſcororas were killed, wounded and taken. The remainder of the tribe ſoon after abandoned their country, and joined the Five Nations, with whom they have ever ſince remained. The lords proprietors having refuſed to contribute towards the expences of an expedition, of which they were to ſhare the immediate benefits, were deprived of their prerogative, except Lord Granville, who ſtill retained his eighth part. The reſt received a recompence of about 24,000l. The colony was taken under the immediate protection of the crown, and from that time began to flouriſh. The diviſion into North and South Carolina now took place, and from that time peace being reſtored unto the internal government as well as with the Cherokees and other Indian tribes, theſe provinces began to breathe, and their trade increaſed with wonderful rapidity. See North Carolina and South-Carolina (A).



CAROLINE. See Carline.

*Caroline-Books*, the name of four books, compoſed by order of Charlemagne, to refute the ſecond council of Nice. Theſe books are couched in very harſh and ſevere terms, containing 120 heads of accuſation againſt the council of Nice, and condemning the worſhip of images.

CAROLOSTADIANS, or Carlostadians, an ancient ſect or branch of Lutherans, who denied the real preſence of Chriſt in the eucharíſt.

They were thus denominated from their leader Andrew Caroloſtadius, who having originally been archdeacon of Wittemberg, was converted by Luther, and was the firſt of all the reformed clergy who took a wife: but diſagreeing afterwards with Luther, chiefly in the point of the ſacrament, founded a ſect apart. The Caroloſtadians are the ſame with what are otherwiſe denominated Sacramentarians, and agree in moſt things with the Zuinglians.

CAROLUS, an ancient Engliſh broad piece of gold ſtruck under Charles I. Its value has of late been at 23 ſhillings Sterling, though at the time it was coined it is ſaid to have been rated at 20 ſhillings.

Carolus, a ſmall copper coin, wih a little ſilver mixed with it, ſtruck under Charles VIII. of France. The carolus was worth 12 deniers when it ceaſed to be current. Thoſe which are ſtill current in trade in Lorrain, or in ſome neighbouring provinces, go under the name of French ſols.

CAROTIDS, in anatomy, two arteries of the neck, which convey the blood from the aorta to the brain: one called the right, and the other the left, carotid.

CARP, in ichthyology, the Engliſh name of a ſpecies of cyprinus. See Cyprinus; alſo *Carp-Fiſhing*.

The carp is the moſt valuable of all kinds of fiſh for ſtocking of ponds. It is very quick in its growth, and brings forth the ſpawn three times a year, ſo that the increaſe is very great. The female does not begin to breed till eight or nine years old; ſo that in breeding-ponds a ſupply muſt be kept of carp of that age. The

(A) As communications of importance have been promiſed to the publiſher concerning theſe States, it was judged expedient to refer further particulars to the above articles.

The best judges allow, that, in stocking a breeding-pond, four males should be allowed to twelve females. The usual growth of a carp is two or three inches in length in a year; but, in ponds which receive the fattening of common sewers, they have been known to grow from five inches to 18 in one year. A feeding-pond of one acre extent will very well feed 300 carp of three years old, 300 of two years, and 400 of one year old. Carp delight greatly in ponds that have marley sides; they love also clay-ponds well sheltered from the winds, and grown with weeds and long grass at the edges, which they feed on in the hot months. Carp and tench thrive very fast in ponds and rivers near the sea, where the water is a little brackish; but they are not so well tasted as those which live in fresh water. Grains, blood, chicken-guts, and the like, may at times be thrown into carp-ponds, to help to fatten the fish. To make them grow large and fat, the growth of grass under the water should by all means possible be encouraged. For this purpose, as the water decreases in the summer, the sides of the pond left naked and dry should be well raked with an iron rake, to destroy all the weeds, and cut up the surface of the earth; hay-seed should then be sown plentifully in these places; and more ground prepared in the same manner, as the water falls more and more away. By this means there will be a fine and plentiful growth of young grass along the sides of the pond to the water's edge; and when the rains fill up the pond again, this will be all buried under the water, and will make a feeding-place for the fish, where they will come early in the morning, and will fatten greatly upon what they find there.

CARPATES, or Apes Bastarnicae, (anc. geog.) a range of mountains, running out between Poland, Hungary, and Transylvania. Now called the Carpathian Mountains.

CARPATHIUM, (Mare, Horace, Ovid); the sea that washes the island Carpathus.

CARPATHUS, an island on the coast of Asia, two hundred stadia in compass, and an hundred in length. Its name is said to be from its situation on the coast of Caria. It lies between Rhodes and Crete, in the sea which, from this island is called the Carpathian Sea, and has to the north the Ionian, to the south the Egyptian, to the west the Cretan and African seas. It is two hundred furlongs in compass, and a hundred in length. It had anciently according to Strabo, four cities; according to Scylax only three. Ptolemy mentions but one, which he calls Posidium. This island is now called Scarpanto.

CARPÆA a kind of dance anciently in use among the Athenians and Magnesians, performed by two persons, the one acting a labourer, the other a robber. The labourer, laying by his arms, goes to ploughing and sowing, still looking warily about him as if afraid of being surprised: the robber at length appears, and the labourer quitting his plough, betakes himself to his arms, and fights in defence of his oxen. The whole was performed to the sound of flutes, and in cadence. Sometimes the robber was overcome and sometimes the labourer; the victor's reward being the oxen and plough. The design of the exercise was to teach and accustom the peasants to defend themselves against the attacks of ruffians.



CARPENTER, a person who practices Carpentry. The word is formed from the French *charpentier*, which signifies the same, formed of *charpente*, which denotes timber; or rather from the Latin *carpentarius*, a maker of *carpenta*, or carriages.

*Carpenter of a Ship*, an officer appointed to examine and keep in order the frame of a ship, together with her masts, yards, boats, and all other wooden machinery. It is his duty in particular to keep the ship *tight*; for which purpose he ought frequently to review the decks and sides, and to caulk them when it is necessary. In the time of battle, he is to examine up and down, with all possible attention, in the lower apartments of the ship, to stop any holes that may have been made by shot, with wooden plugs provided of several sizes.

CARPENTERAS, an episcopal town of Provence in France, and capital of Venaissin. It is subject to the pope; and is seated on the river Auson, at the foot of a mountain. E. Long. 5. 6. N. Lat. 44. 4.

CARPENTRY, the art of cutting, framing, and joining large pieces of wood, for the uses of building. It is one of the arts subservient to architecture, and is divided into house-carpentry and ship-carpentry: the first is employed in raising, roofing, flooring of houses, *&c.* and the second the building of ships*, barges, *&c.* The rules in carpentry are much the same with those of Joinery; the only difference is, that carpentry is used in the large and coarser work, and joinery in the smaller and curious.

* See *Ship-building*.

CARPENTUM, in antiquity, a name common to divers sorts of vehicles, answering to coaches as well as waggons, or even carts among us. The carpentum was originally a kind of car or vehicle in which the Roman ladies were carried; though in after times it was also used in war. Some derive the word from *carro*; others from *Carmenta* the mother of Evander, by a conversion of the *m* into *p*.

CARPET, a sort of covering of stuff, or other materials, wrought with the needle or on a loom, which is part of the furniture of a house, and commonly spread over tables, or laid upon the floor.

Persian and Turkey carpets are those most esteemed: though at Paris there is a manufactory after the manner of Persia, where they make them little inferior, not to say finer than the true Persian carpets. They are velvety, and perfectly imitate the carpets which come from the Levant. There are also carpets of Germany, some of which are made of woollen stuffs, as serges, *&c.* and called square carpets: others are made of wool also, but wrought with the needle, and pretty often embellished with silk; and, lastly, there are some made of dogs hair. There are likewise carpets made in Britain, which are used either as floor-carpets, or to cover chairs, &c. It is true, they are not arrived at the like perfection in this manufacture with their neighbours the French; but may not this be owing to the want of a like public encouragement?

CARPI, a principality of Modena in Italy, lying about four leagues from that city. It formerly belonged to the house of Pio; the elder sons of which bore the title of *Princes of St Gregory*. In the beginning of the 14th century *Manfroy* was the first prince of Carpi; but in the 16th, the emperor Cha. V. gave the principality to Alfonzo duke of Ferrara.

This nobleman, in recompence, gave to Albert Pio, to whom the principality of Carpi belonged of right, the town of Saſſuolo and ſome other lands. Albert was, however, at laſt obliged to retire to Paris, where, being ſtripped of all his eſtates, he died in 1538, with the reputation of being one of the beſt and braveſt men of his age. The family of Pio is yet in being, and continues attached to the French court. Some of them have even been raiſed to the purple, and ſtill make a figure in Europe.

Carpi, a town of Italy in the duchy of Modena, and capital of the laſt mentioned principality. It has a ſtrong caſtle, and is ſituated in E. Long. 11. 12. N. Lat. 44. 45.

Carpi, a town of the Veroneſe in Italy, memorable for a victory gained by the Imperialiſts over the French in 1701. It is ſubject to the Venetians; and is ſituated on the river Adige, in E. Long. 11. 39. N. Lat. 45. 10.

CARPI, (Ugo da) an Italian painter, of no very conſiderable talents in that art, but remarkable for being the inventor of that ſpecies of engraving on wood, diſtinguiſhed by the name of chiaro-ſcuro, in imitation of drawing. This is performed by uſing more blocks than one; and Ugo da Carpi uſually had three; the firſt for the outline and dark ſhadows, the ſecond for the lighter ſhadows, and the third for the half tint. In that manner he ſtruck off prints after ſeveral deſigns, and cartons of Raphael; particularly one of the Sybil, a Deſcent from the Croſs, and the Hiſtory of Simon the Sorcerer. He died in 1500. This art was brought to a ſtill higher degree of perfection by Balthaſar Peruzzi of Siena, and Parmigiano, who publiſhed ſeveral excellent deſigns in that manner.

Carpi, (Girolamo da) hiſtory and portrait painter, was born at Ferrara in 1501, and became a diſciple of Garofalo. When he quitted that maſter, he devoted his whole time, thoughts, and attention, to ſtudy the works of Correggio, and to copy them with a moſt critical care and obſervation; in which labour he ſpent ſeveral years at Parma, Modena, and other cities of Italy, where the beſt works of that exquiſite painter were preſerved. He acquired ſuch an excellence in the imitation of Correggio's ſtyle, and copying his pictures, that many paintings finiſhed by him were taken for originals, and not only admired, but were eagerly purchaſed by the connoiſſeurs of that time. Nor is it improbable that ſeveral of the paintings of Girolamo da Carpi paſs at this day for the genuine work of Correggio himſelf. He died in 1556.

CARPINUS, the horn-beam, in botany: A genus of the polyandria order, belonging to the monœcia claſs of plants; and in the natural mothod ranking under the 50th order, *Amentaceæ*. The calyx of the male is monophyllous and ciliated; there is no corolla, but 20 ſtamina. The calyx of the female is monophyllous and ciliated; no corolla; two germens, with two ſtyles on each. The fruit is an egg-ſhaped nut. There are two ſpecies, *viz*.

1. The betulus, or common hornbeam; a deciduous tree, native of Europe and America. Its leaves are of a darkiſh green, and about the ſize of thoſe of the beech, but more pointed and deeply ſerrated. Its branches are long, flexible, and crooked: yet in their general appearance very much reſemble thoſe of the beech: indeed there is ſo great a likeneſs between thoſe two trees, eſpecially in the ſhrubby and underwood ſtate, that it would be difficult to diſtinguiſh them at the firſt glance, were it not for that gloſſy varniſh with which the leaves of the beech are ſtrongly marked. In the days of Evelyn, when topiary work was the gardener's idol, the hornbeam might be conſidered as deſerving of thoſe endearing expreſſions which that enthuſiaſtic writer has been pleaſed to laviſh upon it; nevertheleſs, as an ornamental in modern gardening it ſtands low; and its preſent uſes are few. As an underwood it affords ſtakes and edders, fuel and charcoal. Its timber ranks with that of the beech and the ſycamore; and the inner bark is ſaid to be much uſed in Scandinavia to dye yellow. The only ſuperior excellency of the hornbeam lies in its fitneſs for ſkreen fences for ſheltering gardens, nurſeries, and young plantations from the ſeverities of the winter ſeaſon. It may be trained to almoſt any height, and by keeping it trimmed on the ſides it becomes thick of branches, and conſequently thick of leaves; which being by their nature retained upon the plant after they wither, a hornbeam hedge occaſions a degree of ſhelter nearly equal to that given by a brick wall. Indeed, being leſs reflective than that expenſive ſkreen, it affords a more uniform temperature of air to the plants which ſtand near it. In this point of view, too, the hornbeam is uſeful to be planted promiſcuouſly, or in alternate rows, amongſt more tender plants in expoſed ſituations, in the ſame manner as the birch; to which it has more than one preference: namely, it is warmer in winter,—and Hanbury ſays, the hornbeam is peculiarly grateful to hares and rabbits; conſequently it may prevent their injuring its more valuable neighbours: yet, like Evelyn, he ſeems to be of opininon that it is diſaffected by deer. If this be really the caſe, the hornbeam may upon many occaſions be introduced into the deer-parks with ſingular propriety.

Of this ſpecies there are three varieties: The Eaſtern Hornbeam, Flowering Hornbeam, American Hornbeam. The eaſtern hornbeam arrives to the leaſt height of all the ſorts; about ten feet is the fartheſt of its growth, and it looks pretty enough with trees of the ſame growth. The leaves are by no means ſo large as the common ſort; and as the branches are always cloſer in proportion to the ſmallneſs of the leaves, where a low hedge is wanted of the deciduous kind, this would not be an improper tree for the purpoſe, either to be kept ſheered, or ſuffered to grow in its natural ſtate. The bark of this ſort is more ſpotted than that of the common. The flowering hornbeam is the moſt free ſhooter of any of the ſorts; and will arrive to be the higheſt, the common hornbeam only excepted. It will grow to be thirty or forty feet high. The branches of this tree are leſs ſpotted with greyiſh ſpots than any of the other ſorts. The leaves are very rough, of a dark-green colour, and are longer than the common ſort. The property which the common hornbeam is poſſeſſed of, of retaining its leaves all winter, does not belong to this ſort, the leaves of which conſtantly fall off in the autumn with other deciduous trees. American hornbeam is a more elegant tree than any of the former ſorts. The branches are ſlender, covered with a browniſh ſpeckled bark, and are more ſparingly ſent forth than from any of the others

others. The leaves are oblong, pointed, and of a palish green, and are not nearly so rough as the common hornbeam, though the flowers and fruit are produced in the same manner.

2. The ostrya, or hop-hornbeam, a native of Italy and of Virginia. This is of taller growth than the eastern kind. It will arrive to the height of twenty feet, or more. The leaves are nearly the size of the common sort, and some people admire this tree on account of the singular appearance it makes with its seeds, before they begin to fall. There is a variety which grows to thirty feet high, shoots freely, has long rough leaves like those of the elm, and longish yellow-coloured flowers, called the *Virginian flowering hop-hornbeam*.

*Propagation*. The common hornbeam may be propagated either by layering (at almost any time of the year), or from seeds in the following manner: In the autumn the seeds will be ripe; when, having gathered a sufficient quantity for the purpose, let them be spread upon a mat a few days to dry. After this, they should be sown in the seminary-ground, in beds four feet wide, with an alley of about two feet, and from one to two inches deep. In this bed they must remain till the second spring before they make their appearance; and all the summer they lie concealed, the weeds should constantly be plucked up as soon as they peep; for if they are neglected, they will get so strong, and the fibres of their roots will be so far struck down among the seeds, as to endanger the drawing many seeds out with them, on weeding the ground. After the young plants appear, they should constantly be kept clear of weeds during the next summer; and if they were to be now and then gently refreshed with water in dry weather, it would prove serviceable to them. In the spring following they may be taken out of these beds, and planted in the nursery, in which situation they may remain till they are of a sufficient size to plant out for standards.

The other sorts are to be propagated by layers; for which purpose a few plants for stools must be procured. The stools of the eastern hornbeam should be planted a yard, and the other sorts a yard and a half or two yards asunder. After these plants have made some young shoots, they should be layered in the autumn, and by that time twelvemonth they will have struck root; at which time, or any time in the winter, or early in the spring, they should be taken off, and planted in the nursery-way, observing always to brush up the stool, that it may afford fine young shoots for fresh layering by the autumn following. The distance the plants should be allowed in the nursery need be no more than one foot, in rows that are two feet asunder; and here they may stand, with the usual nursery care of weeding and digging the rows in winter, until they are to be finally planted out; though the Virginian hornbeam will frequently send forth two shoots, which will seem to strive for mastery in the lead. When this is observed, the weakest should always be taken away, otherwise the tree will grow forked.

CARPOBALSAM, in the Materia Medica, the fruit of the tree which yields the true oriental balsam. The carpobalsam is used in Egypt, according to Prosper Alpinus, in all the intentions in which the balsam itself is applied: but the only use the Europeans make of it is in Venice treacle and mithridate; and in these not a great deal, for cubebs and juniper berries are generally substituted in its place.



CARPOCRATIANS, a branch of the ancient Gnostics, so called from *Carpocrates*, who in the second century revived and improved upon the errors of Simon Magus, Menander, Saturnius, and other Gnostics. He owned, with them, one sole principle and father of all things, whose name as well as nature was unknown. The world, he taught, was created by angels, vastly inferior to the first principle. He opposed the divinity of Jesus Christ; making him a mere man, begotten carnally on the body of Mary by Joseph, though possessed of uncommon gifts which set him above other creatures. He inculcated a community of women; and taught, that the soul could not be purified, till it had committed all kinds of abominations, making that an necessary condition of perfecfection.

CARPOLITHI, or FRUIT-STONE ROCKS of the Germans, are composed of a kind of jasper, of the nature of the amygdaloides, or almond-stones. Bretrand asserts that the latter are those which appear to be composed of elliptical pieces like petrified almonds, though in truth they are only small oblong pieces of calcareous stone rounded by attrition, and sometimes small muscle-shells connected by a stony concretion. The name of carpolithi, however, is given in general by writers on fossils to all sorts of stony concretions that have any resemblance to fruit of whatever kind.

CARPUS, the wrist. See ANATOMY, n° 53.

CARR, a kind of rolling throne, used in triumphs, and at the splendid entries of princes. See CHARIOT.

The word is from the ancient Gaulish, or Celtic, *Carr*; mentioned by Cæsar, in his commentaries, under the name *Carrus*. Plutarch relates, that Camillus having entered Rome in triumph, mounted on a carr drawn by four white horses, it was looked on as too haughty an innovation.

CARR is also used for a kind of light open chariot. The carr, on medals, drawn either by horses, lions, or elephants, usually signifies either a triumph or an apotheosis: sometimes a procession of the images of the gods at a solemn supplication, and sometimes of those of some illustrious family at a funeral. The carr covered and drawn by mules, only signifies a consecration, and the honour done any one of having his image carried at the games of the circus. See CONSECRATION, &c.

CARRAC, or CARRACA, a name given by the Portuguese to the vessels they send to Brasil and the East-Indies; being very large, round built, and fitted for fight as well as burden. Their capacity lies in their depth, which is very extraordinary. They are narrower above than underneath, and have sometimes seven or eight floors; they carry about 2000 tons, and are capable of lodging 2000 men; but of late they are little used. Formerly they were also in use among the knights of Rhodes, as well as among the Genoese, and other Italians. It is a custom among the Portuguese, when the carracs returned from India, not to bring any boat or sloop for the service of the ship beyond the island of St Helena; at which place they

Carrara ‖ Carrick.

they sink them on purpose, in order to take from the crew all hopes or possibility of saving themselves, in case of shipwreck.

CARRARA MARBLE, among artificers, the name of a species of white marble, which is called *marmor lunense*, and *ligustrium* by the ancients: it is distinguished from the Parian, now called the statuary marble, by being harder and less bright.

CARRAVEIRA, a town of Turkey in Europe, with a Greek archbishop's see. E. Long. 22. 25. N. Lat. 40. 27.

CARRIAGE, a vehicle serving to convey persons, goods, merchandizes, and other things, from one place to another.

For the construction and mechanical principles of wheel-carriages, see MECHANICS.

*CARRIAGE of a cannon*, the frame or timber-work on which it is mounted, serving to point it for shooting, or to carry it from one place to another. It is made of two planks of wood, commonly one half the length of the gun, called the cheeks, and joined by three wooden transums, strengthened with three bolts of iron. It is mounted on two wheels, but on a march has two fore-wheels with limbers added. The principal parts of a carriage are the cheeks, transums, bolts, plates, train, bands, bridge, bed, hooks, trunnion holes, and cap-square.

*Block-CARRIAGE*, a cart made on purpose for carrying mortars and their beds from place to place.

*Truck-CARRIAGE*, two short planks of wood, supported on two axle-trees, having four trucks of solid wood for carrying mortars or guns upon battery, where their own carriages cannot go. They are drawn by men.

CARRICK, the southern division of the shire of Ayr in Scotland. It borders on Galloway; stretches 32 miles in length; and is a hilly country fit for pasturage. The chief rivers are the Stencher and Girven, both abounding with salmon; here are also several lakes and forests; and the people on the coast employ themselves in the herring-fishery, though they have no harbour of any consequence. The only towns of this district are Bargeny and Maybole, two inconsiderable villages, yet the first gave the title (now extinct) of baron to a branch of the Hamilton family. The prince of Wales, as prince of Scotland, is earl of Carrick.

*CARRICK on the Sure*, a town of Ireland, in the county of Tipperary and province of Munster. W. Long. 7. 14. N. Lat. 52. 16.

*CARRICK-Fergus*, a town of Ireland, in the county of Antrim and province of Ulster. It is a town and county in itself, and sends two members to parliament. It is very rich and populous, with a good harbour; and is governed by a mayor, recorder, and sheriffs.—It has, however, been of far greater consequence than at present, as appears from the mayor having been admiral of a considerable extent of coast in the counties of Down and Antrim, and the corporation enjoying the customs paid by all vessels within these bounds, the creeks of Belfast and Bangor excepted. This grant was repurchased, and the custom-house transferred to Belfast—Here is the skeleton of a fine house built by Lord Chichester in the reign of James I. an old Gothic church with many family monuments, and a very large old castle. The town was formerly walled round, and some part of the walls is still remaining entire.—Carrick-fergus is seated on a bay of the same name in the Irish channel; and is noted for being the landing place of king William in 1690. Here also Thurot made a descent in 1759, took possession of the castle, and carried away hostages for the ransom of the town; but being soon after pursued by commodore Elliot, his three ships were taken, and he himself was killed.

Carrier.

CARRIER, is a person that carries goods for others for hire. A common carrier, having the charge and carriage of goods, is to answer for the same, or the value, to the owner. And where goods are delivered to a carrier, and he is robbed of them, he shall be charged and answer for them, because of the hire. If a common carrier who is offered his hire, and who has convenience, refuses to carry goods, he is liable to an action, in the same manner as an inn-keeper who refuses to entertain a guest. See ASSUMPSIT.

One brought a box to a carrier, with a large sum of money, and the carrier demanded of the owner what was in it; he answered, that it was filled with silks, and such like goods: upon which the carrier took it, and was robbed, and adjudged to make it good; but a special acceptance, as, *provided there is no charge of money*, would have excused the carrier.—A person delivered to a carrier's book-keeper two bags of money sealed up, to be carried from London to Exeter, and told him that it was L.200, and took his receipt for the same, with promise of delivery for 10s. *per cent.* carriage and risk: though it be proved that there was L. 400 in the bags, if the carrier be robbed, he shall answer only for L. 200, because there was a particular undertaking for that sum and no more; and his reward, which makes him answerable, extends no farther. If a common carrier loses goods which he is intrusted to carry, a special action on the case lies against him, on the custom of the realm, and not trover; and so of a common carrier by boat. An action will lie against a porter, carrier, or barge-man, upon his bare receipt of the goods, if they are lost through negligence. Also a lighter man spoiling goods he is to carry, by letting water come to them, action of the case lies against him, on the common custom.

*Jacob's Law Dict.*

*CARRIER-Pigeon*, or *courier-pigeon*, a sort of pigeon used, when properly trained, to be sent with letters from one place to another. See COLUMBA.

Though you carry these birds hood-winked, 20, 30, nay 60 or 100 miles, they will find their way in a very little time to the place where they were bred. They are trained to this service in Turkey and Persia; and are carried first, while young, short flights of half a mile, afterwards more, till at length they will return from the farthest part of the kingdom. Every Bashaw has a basket of these pigeons bred in the seraglio, which, upon any emergent occasion, as an insurrection, or the like, he dispatches, with letters braced under their wings, to the seraglio; which proves a more speedy method, as well as a more safe one, than any other; he sends out more than one pigeon, however, for fear of accidents. Lithgow assures us, that one of these birds will carry a letter from Babylon to Aleppo, which

Carrier, Carron. which is 30 days journey, in 48 hours. This is alſo a very ancient practice; Hirtius and Brutus, at the ſiege of Modena, held a correſpondence with one another by means of pigeons. And Ovid tells us, that Taurosſthenes, by a pigeon ſtained with purple, gave notice to his father of his victory at the Olympic Games, ſending it to him at Ægina.

In modern times, the moſt noted were the pigeons of Aleppo, which ſerved as couriers at Alexandretta and Bagdad. But this uſe of them has been laid aſide for the laſt 30 or 40 years, becauſe the Curd robbers killed the pigeons. The manner of ſending advice by them was this: they took pairs which had young ones, and carried them on horſeback to the place from whence they wiſhed them to return, taking care to let them have a full view. When the news arrived, the correſpondent tied a billet to the pigeon's foot, and let her looſe. The bird impatient to ſee its young, flew off like lightning, and arrived at Aleppo in ten hours from Alexandretta, and in two days from Bagdad. It was not difficult for them to find their way back, ſince Aleppo may be diſcovered at an immenſe diſtance. This pigeon has nothing peculiar in its form, accept its noſtrils, which, inſtead of being ſmooth and even, are ſwelled and rough.

CARRON, a ſmall but remarkable river in Scotland, riſing about the middle of the iſthmus between the friths of Forth and Clyde. Both its ſource, and the place where it emptieth itſelf into the ſea, are within the ſhire of Stirling, which it divides into two nearly equal parts. The whole length of its courſe, which is from weſt to eaſt, is not above 14 miles. It falls into the frith of Forth about three miles to the north-eaſt of Falkirk. The ſtream thereof is but ſmall, and ſcarce deſerves the notice of a traveller; yet there is no river in Scotland, and few in the whole iſland of Britain, whoſe banks have been the ſcene of ſo many memorable tranſactions. When the Roman empire was in all its glory, and had its eaſtern frontiers upon the Euphrates, the banks of Carron were its boundaries upon the north-weſt; for the wall of Antoninus *, which was raiſed to mark the limits of that mighty empire, ſtood in the neighbourhood of this river, and ran parallel to it for ſeveral miles.

* See *Antoninus's Wall*.

Near the middle of its courſe, in a pleaſant valley, ſtand two beautiful mounts, called the *Hills of Dunipace*, which are taken notice of by moſt of the Scottiſh hiſtorians as monuments of great antiquity. The whole ſtructure of theſe mounts is of earth; but they are not both of the ſame form and dimenſions. The more eaſterly one is perfectly round, reſembling an oven, and about fifty feet in height: And that this is an artificial work does not admit of the leaſt doubt; but we cannot aſſirm the ſame, with equal certainty, of the other, though it has been generally ſuppoſed to be ſo too. It bears no reſemblance to the eaſtern one either in ſhape or ſize. At the foundation it is nearly of a triangular form; but the ſuperſtructure is quite irregular; nor does the height thereof bear any proportion to the extent of its baſe. Theſe mounts are now planted with firs, which, with the pariſh-church of Dunipace ſtanding in the middle between them, and the river running hard by, give this valley a very romantic appearance. The common account given of theſe mounts is, that they were erected as monuments of a peace concluded in that place between the Romans and the Caledonians, and that their name partakes of the language of both people; *Dun* ſignifying a hill in the old language of that iſland, and *Pax* "peace" in the language of Rome. The compound word, *Dunipace*, ſignifies "the hills of peace." And we find in hiſtory, that no leſs than three treaties of peace were, at different periods, entered into between the Romans and Caledonians; the firſt, by Severus, about the year 210; the ſecond, ſoon after, by his ſon Caracalla; and the third, by the uſurper Carauſius, about the year 280; but of which of thoſe treaties Dunipace is a monument, we do not pretend to determine. If the concurring teſtimony of hiſtorians and antiquaries did not agree in giving this original to theſe mounts, we would be tempted to conjecture that they are ſepulchral monuments. Human bones and urns have been diſcovered in earthen fabrics of this kind in many parts of Britain, and the little mounts or barrows, which are ſcattered in great numbers about Stonhenge in Saliſbury plain are generally ſuppoſed to have been the ſepulchres of the ancient Britons. See Barrows.

From the valley of Dunipace, the river runs for ſome time in a deep and hollow channel, with ſteep banks on both ſides: here it paſſes by the foundations of the ancient Roman bridge; not far from which, as is generally thought, was the ſcene of the memorable conference betwixt the Scottiſh patriot William Wallace and Robert Bruce, father to the king of that name, which firſt opened the eyes of the latter to a juſt view, both of his own true intereſt and that of his country.

After the river has left the village and bridge of Larbert, it ſoon comes up to another ſmall valley, through the midſt of which it has now worn out to itſelf a ſtraight channel: whereas, in former ages, it had taken a conſiderable compaſs, as appears by the tract of the old bed, which is ſtill viſible. The high and circling banks upon the ſouth-ſide, give to this valley the appearance of a ſpacious bay; and, according to the tradition of the country, there was once an harbour here: nor does the tradition ſeem altogether groundleſs; pieces of broken anchors having been found here, and ſome of them within the memory of people yet alive. The ſtream-tides would ſtill flow near the place, if they were not kept back by the dam-head built acroſs the river at Stenhouſe; and there is reaſon to believe, that the frith flowed conſiderably higher in former ages than it does at preſent. In the near neighbourhood of this valley, upon the ſouth, ſtand the ruins of ancient Camelon; which, after it was abandoned by the Romans, was probably inhabited, for ſome ages, by the natives of the country.

Another ancient monument, called *Arthur's Oven*, once ſtood upon the banks of Carron; but was, with a ſpirit truly Gothic, entirely demoliſhed about 40 years ago. The corner of a ſmall incloſure between Stenhouſe and the Carron iron-works, is pointed out as the place of its ſituation. This is generally ſuppoſed to have been a Roman work; though it is not eaſy to conceive what could be their motive for erecting ſuch a fabric, at ſo great a diſtance from any other of their works, and in a ſpot which, at that time, muſt have been very remote and unfrequented. The form of it is ſaid to have been perfectly round, and riſing perpendicular for ſome yards at firſt, but afterwards gradually contracted, till it terminated in a narrow orifice at the top.

As Carron extends over the half of the iſthmus, and runs ſo near the ancient boundaries of the Roman empire, the adjacent country fell naturally to be the ſcene of many battles and rencounters. Hiſtorians mention a bloody battle fought near this river between the Romans and the confederate army of the Scots and Picts in the beginning of the 5th century. The ſcenes of ſome of Oſſian's poems were, in the opinion of the tranſlator, upon the banks of this river. Here Fingal fought with Caracal, the ſon of the king of the world, ſuppoſed to have been the ſame with Caracalla the ſon of the Roman emperor Severus. Here alſo young Oſcar, the ſon of Oſſian, performed ſome of his heroic exploits. Hereabout was the ſtream of Crona, celebrated in the ancient compoſitions of the Gaelic bard; poſſibly that now called the water of Bonny, which runs in the neighbourhood of the Roman wall, and diſchargeth itſelf into Carron at Dunipace. In thoſe poems, mention is made of a green vale upon the banks of this river, with a tomb ſtanding in the middle of it, where young Oſcar's party and the warriors of Caros met. We only take notice of this as it ſtrengthens the conjecture hazarded above, that the mounts of Dunipace, eſpecially the more eaſterly of them, were ſepulchral monuments.—About the diſtance of half a mile from the river, and near the town of Falkirk, lies the field of that battle which was fought by William Wallace and the Engliſh in the beginning of the 14th century. It goes by the name of *Graham's muir*, from the valiant John Graham, who fell there, and whoſe grave-ſtone is ſtill to be ſeen in the church-yard of Falkirk.

The river Carron, though it hath long ſince ceaſed to roll its ſtream amidſt the din of arms, ſtill preſerves its fame, by lending its aid to trade and manufactures; (ſee the next article.)—The river is navigable for ſome miles near its mouth, and a conſiderable trade is carried on upon it by ſmall craft; for the convenience of which, its channel has of late years been ſtraightened and much ſhortened, and the great Canal* has its entrance from it.

* See the article *Canal*.

*Carron-Works*, a large iron-foundery, two miles north from Falkirk in Scotland. They are conveniently ſituated on the banks of the Carron, three miles above its entry into the frith of Forth. Above 100 acres of land have been converted into reſervoirs and pools, for water diverted from the river, by magnificent dams built about two miles above the works, which, after turning 18 large wheels for the ſeveral purpoſes of the manufacture, falls into a tide-navigation that conveys their caſtings to the ſea.

Theſe works are the greateſt of the kind in Europe, and were eſtabliſhed in 1760. At preſent, the buildings are of vaſt extent; and the machinery, conſtructed by Mr Smeaton, is the firſt in Britain, both in elegance and correctneſs: there are 1600 men employed, to whom is paid weekly above 650 l. Sterling; which has greatly enriched the adjoining country: 6500 tons of iron are ſmelted annually from the mineral with pit-coal, and caſt into cannon, cylinders, *&c.*—In the founding of cannon, theſe works have lately arrived at ſuch perfection, that they make above 5000 pieces a-year, many of which are exported to foreign ſtates; and their guns of *new conſtruction* are the lighteſt and neateſt now in uſe, not excepting braſs guns; the 32 pounder ſhip-gun weighing 42 hundred-weight, the 6 pounder 8 hundred weight and one half, and the other calibers in proportion.



The preſent proprietors are a chartered company, with a capital of 150,000 l. Sterling, a common ſeal, *&c.* but their ſtock is confined to a very few individuals.

CARRONADE, a ſhort kind of ordnance, capable of carrying a large ball, and uſeful in cloſe engagements at ſea. It takes its name from Carron, the place where this ſort of ordnance was firſt made, or the principle applied to an improved conſtruction. See the article GUNNERY, n° 45, 46.

CARROT, in Botany. See DAUCUS.

*Deadly-CARROT.* See THAPSIA.

CARROUSAL, a courſe of horſes and chariots, or a magnificent entertainment exhibited by princes on ſome public rejoicing. It conſiſts in a cavalcade of ſeveral gentlemen, richly dreſſed and equipped after the manner of ancient cavaliers, divided into ſquadrons, meeting in ſome public place, and practiſing juſts, tournaments, &c. The laſt carrouſals were in the reign of Louis XIV.—The word comes from the Italian word *caroſello*, a diminutive of *carro*, "chariot." Tertullian aſcribes the invention of carrouſals to Circe; and will have them inſtituted in honour of the Sun, her father; whence ſome derive the word from *carrus* or *currus ſolis*. The Moors introduced cyphers, liveries, and other ornaments of their arms, with trappings, &c. for their horſes. The Goths added creſts, plumes, &c.

CARRUCA, in antiquity, a ſplendid kind of carr, or chariot, mounted on four wheels, richly decorated with gold, ſilver, ivory, &c. in which the emperors, ſenators, and people of condition, were carried. The word comes from the Latin *carrus*, or Britiſh carr, which is ſtill the Iriſh name for any wheel-carriage.

CARRUCA, or CARUCA, is alſo uſed in middle-age writers for a plough.

CARRUCA was alſo ſometimes uſed for *carrucata*. See CARRUCATE.

CARUCAGE, (*carucagium*,) a kind of tax anciently impoſed on every plough, for the public ſervice. See CARRUCATE and HIDAGE.

CARRUCAGE, CARUCAGE, or CARUAGE, in huſbandry, denotes the ploughing of ground, either ordinary, as for grain, hemp, and flax; or extraordinary, as for woad, dyers weed, rape, and the like.

CARRUCATE, (*carrucata*,) in ancient laws and hiſtory, denotes a plough-land, or as much arable ground as can be tilled in one year with one plough.

In Doomſday Inquiſition, the arable land is eſtimated in carrucates, the paſture in hides, and meadow in acres. Skene makes the *carrucata* the ſame with *hilda* or *hida terræ*; Littleton the ſame with ſoc.

The meaſure of a carrucate appears to have differed in reſpect of place as well as time. In the reign of Richard I. it was eſtimated at 60 acres, and in another

nother charter of the same reign at 100 acres: in the time of Edward I. at 180 acres: and in the 23d of Edward III. a carrucate of land in Burchester contained 112 acres, and in Middleton 150 acres.

By a statute under William III. for charging persons to the repair of the highways, a plough-land is rated at a fifty pound *per annum*, and may contain houses, mills, wood, pasture, &c.

CARRYING, in falconry, signifies a hawk's flying away with the quarry. Carrying is one of the ill qualities of a hawk, which she acquires either by a dislike of the falconer, or not being sufficiently broke to the lure.

CARRYING, among huntsmen. When a hare runs on rotten ground (or even sometimes in a frost), and it sticks to her feet, they say she carries.

CARRYING, among riding-masters. A horse is said to carry low, when having naturally an ill-shaped neck, he lowers his head too much. All horses that arm themselves carry low, but a horse may carry low without arming. A French branch, or gigot, is prescribed as a remedy against carrying low.

A horse is said to carry well, when his neck is raised, or arched, and he holds his head high and firm, without constraint.

*Carrying wind*, a term used by dealers in horses to express such a one as frequently tosses his nose as high as his ears, and does not carry handsomely. This is called *carrying wind*; and the difference between carrying in the wind, and beating upon the hand, is this: that the horse who beats upon the hand, shakes the bridle and resists it, while he shakes his head; but the horse that carries in the wind puts up his head without shaking, and sometimes beats upon the hand. The opposite to carrying in the wind, is arming and carrying low; and even between these two there is a difference in wind.

CARS, or KARS, a considerable and strong town of Asia, in Armenia, seated on a river of the same name, with a castle almost impregnable. E. Long. 43. 50. N. Lat. 41. 30.

CARSE, or *Carse of Cowry*, a district of Perthshire in Scotland. It lies on the north side of the Tay, and extends 14 miles in length from Dundee to Perth, and is from two to four in breadth. It is a rich plain country, cultivated like a garden, and producing as good harvests of wheat as any in Great Britain. It abounds with all the necessaries of life; but from its low damp situation, the inhabitants are subject to agues and the commonalty are in great want of firing. In this district, not far from the Tay, stands the house of Errol, which formerly belonged to the Earls of that name, the chiefs of the ancient family of Hay, hereditary constables of Scotland.

CARSTAIRS, (William) an eminent Scots Divine, whose merit and good fortune called him to act in great scenes, and to associate with men to whose society and intercourse his birth gave him few pretensions to aspire. A small village, in the neighbourhood of Glasgow, was the place of his nativity. His father, of whom little is known, exercised the functions of a clergyman.

Young Carstairs turned his thoughts to the profession of theology; and the persecutions and oppressions of government, both in regard to civil and religious liberty, having excited his strongest indignation, it became a matter of prudence that he should prosecute his studies in a foreign university. He went accordingly to Utrecht; and his industry and attention being directed with skill, opened up and unfolded those faculties which he was about to employ with equal honour to his country and himself.



During his residence abroad, he became acquainted with Pensionary Fagel, and entered with warmth into the interest of the Prince of Orange. On his return to Scotland to procure a licence to teach doctrines which he had studied with the greatest care, he became disgusted with the proud and insolent conduct of Archbishop Sharp, and prepared to revisit Holland; where he knew that religious liberty was respected, and where he hoped he might better his condition by the connexions he had formed.

His expectations were not vain. His prudence, his reserve, and his political address, were strong recommendations of him to the Prince of Orange; and he was employed in personal negociations in Holland, England, and Scotland. Upon the elevation of his master to the English throne, he was appointed the King's chaplain for Scotland, and employed in settling the affairs of that kingdom. William, who carried politics into religion, was solicitous that episcopacy should prevail there as universally as in England. Carstairs, more versant in the affairs of his native country, saw all the impropriety of this project, and the danger that would arise from the enforcing of it. His reasonings, his remonstrances, his intreaties, overcame the firmness of king William. He yielded to considerations founded alike in policy and in prudence; and to Carstairs, Scotland is indebted for the full establishment of its church in the Presbyterian form of government.

The death of King William was a severe affliction to him; and it happened before that Prince had provided for him with the liberality he deserved. He was continued, however, in the office of chaplain for Scotland by Queen Anne; and he was invited to accept the Principality of the University of Edinburgh. He was one of the ministers of the city, and four times moderator of the general assembly. Placed at the head of the church, he prosecuted its interest with zeal and with integrity. Nor were his influence and activity confined to matters of religion. They were exerted with success in promoting the culture of the arts and sciences. The universities of Scotland owe him obligations of the highest kind. He procured, in particular, an augmentation of the salaries of their professors; a circumstance to which may be ascribed their reputation, as it enabled them to cultivate with spirit the different branches of knowledge.

A zeal for truth, a love of moderation and order, prudence and humanity, distinguished Principal Carstairs in an uncommon degree. His religion had no mixture of austerity; his secular transactions were attended with no imputation of artifice; and the versatility of his talents made him pass with ease from a court to a college. He was among the last who suffered torture before the privy-council, in order to make him divulge the secrets intrusted to him, which he firmly resisted; and after the revolution, that inhuman instrument the thumb-screw was given to him in a present by the council.—This excellent person died in 1715; and in 1774 his *State-papers and Letters*, with an account of his life, were published in one vol. 4to, by the Rev. Dr M'Cormick.

CARSUGHI, (Rainier) a Jesuit, born at Citerna in Tuscany, in 1647, was the author of a Latin poem, entitled, *Ars bene scribendi*, which is esteemed both for the elegance of the style and for the excellent precepts it contains. He also wrote some good epigrams. He died in 1709.

CARTAMA, a town of Spain in the kingdom of Grenada, formerly very considerable. It is seated at the foot of a mountain, near the river Guadala-Medina, in W. Long. 4. 28. N. Lat. 36. 40.

CART, a land-carriage with two wheels, drawn commonly by horses, to carry heavy goods, &c. from one place to another. The word seems formed from the French *charrette*, which signifies the same, or rather the Latin *carreta*, a diminutive of *carrus*. See CARR.

In London and Westminster carts shall not carry more than twelve sacks of meal, seven hundred and fifty bricks, one chaldron of coals, &c. on pain of forfeiting one of the horses, (6 Geo. I. cap. 6.) By the laws of the city, carr-men are forbidden to ride either on their carts or horses. They are to lead or drive them on foot through the streets on the forfeiture of ten shillings, (Stat. 1. Geo. I. cap. 57.) Criminals used to be drawn to execution in a cart. Bawds and other malefactors are whipped at the cart's tail.

Scripture makes mention of a sort of carts or drags used by the Jews to do the office of threshing. They were supported on low thick wheels, bound with iron, which were rolled up and down on the sheaves, to break them, and force out the corn. Something of the like kind also obtained among the Romans, under the denomination of *plaustra*, of which Virgil makes mention, (Georg. I.)

*Tardaque Eleusinæ matris volventia plaustra,*
*Tribulaque, traheæque.*——

On which Servius observes, that *trahea* denotes a cart without wheels, and *tribula* a sort of cart armed on all sides with teeth, used chiefly in Africa for threshing corn. The Septuagint and St Jerome represent these carts as furnished with saws, insomuch that their surface was beset with teeth. David having taken Rabbah, the capital of the Ammonites, ordered all the inhabitants to be crushed to pieces under such carts, moving on wheels set with iron teeth; and the king of Damascus is said to have treated the Israelites of the land of Gilead in the same manner.

*CART-Bote*, in law, signifies wood to be employed in making and repairing instruments of husbandry.

*CARTS of War*, a peculiar kind of artillery anciently in use among the Scots. They are thus described in an act of parliament, A. D. 1456: "It is thocht speidfull, that the King mak requeist to certain of the great burrous of the land that are of ony myght, to mak carts of weir, and ilk cart twa gunnis, and ilk ane to have twa chalmers, with the remanent of the graith that effeirs thereto, and an cunnand man to shut thame." By another act, A. D. 1471, the prelates and barons are commanded to provide such carts of war against their old enemies the English.

CARTE, (Thomas) the historian, was the son of Mr Samuel Carte prebendary of Litchfield, and born in 1686. When he was reader in the abbey-church at Bath, he took occasion, in a 30th of January sermon, 1714, to vindicate Charles I. with respect to the Irish massacre, which drew him into a controversy with Mr Chandler the dissenting minister; and on the accession of the present royal family he refused to take the oaths to government, and put on a lay habit. He is said to have acted as a kind of secretary to Bishop Atterbury before his troubles; and in the year 1722, being accused of high treason, a reward of 1000*l.* was offered for apprehending him: but Queen Caroline, the great patroness of learned men, obtained leave for him to return home in security. He published, 1. An edition of Thuanus, in seven volumes folio. 2. The Life of the first Duke of Ormond, three volumes, folio. 3. The history of England, four volumes, folio. 4. A Collection of Original Letters and Papers concerning the affairs of England, two volumes octavo; and some other works. He died in April 1754.—His history of England ends in 1654. His design was to have brought it down to the Revolution; for which purpose he had taken great pains in copying every thing valuable that could be met with in England, Scotland, France, Ireland, &c.—He had (as he himself says, p. 43. of his Vindication of a full answer to a letter from a bystander), "read abundance of collections relating to the time of King Charles II. and had in his power a series of memoirs from the beginning to the end of that reign; in which all those intrigues and turns at court, at the latter end of that king's life, which bishop Burnet, with all his goût for tales of secret history, and all his genius for conjectures, does not pretend to account for, are laid open in the clearest and most convincing manner; by the person who was most affected by them, and had the best reason to know them."—At his death, all his papers came into the hands of his widow, who afterwards married Mr Jernegan, a member of the church of Rome. They are now deposited in the Bodleian library, having been delivered by Mr Jernegan to the university, 1778, for a valuable consideration. Whilst they were in this gentleman's possession, the earl of Hardwicke paid 200*l.* for the perusal of them. For a consideration of 300*l.* Mr Macpherson had the use of them; and from these and other materials compiled his history and state-papers. Mr Carte was a man of a strong constitution and indefatigable application. When the studies of the day were over, he would eat heartily; and in conversation was cheerful and entertaining.



*CARTE-Blanche*, a sort of white paper, signed at the bottom with a person's name, and sometimes also sealed with his seal, giving another person power to superscribe what conditions he pleases. Much like this is the French *blanc signe*, a paper without writing, except a signature at the bottom, given by contending parties to arbitrators or friends, to fill up with the conditions they judge reasonable, in order to end the difference.

CARTEL, an agreement between two states for the exchange of their prisoners of war.

CARTEL signifies also a letter of defiance or a challenge to decide a controversy either in a tournament or in a single combat. See DUEL.

*CARTEL-Ship*, a ship commissioned in time of war to exchange

Cartes. exchange the prisoners of any two hostile powers; also to carry any particular request or proposal from one to another: for this reason, the officer who commands her is particularly ordered to carry no cargo, ammunition, or implements of war, except a single gun for the purpose of firing signals.

CARTES, (Rene des) descended of an ancient family in Touraine in France, was one of the most eminent philosophers and mathematicians in the 17th century. At the Jesuits College at la Fleche, he made a very great progress in the learned languages and polite literature, and became acquainted with Father Marsenne. His father designed him for the army; but his tender constitution then not permitting him to expose himself to such fatigues, he was sent to Paris, where he launched into gaming, in which he had prodigious success. Here Marsenne persuaded him to return to study; which he pursued till he went to Holland, in May 1616, where he engaged as a volunteer among the prince of Orange's troops. While he lay in garrison at Breda, he wrote a *treatise on music*, and laid the foundation of several of his works. He was at the siege of Rochelle in 1628; returned to Paris; and, a few days after his return, at an assembly of men of learning in the house of Monsignor Bagni the Pope's Nuncio, was prevailed upon to explain his sentiments with regard to philosophy, when the nuncio urged him to publish his system. Upon this he went to Amsterdam, and from thence to Franeker, where he began his *metaphysical meditations*, and drew up his *discourse on meteors*. He made a short tour to England; and not far from London, made some observations concerning the declination of the magnet. He returned to Holland, where he finished his *treatise on the world*.

His books made a great noise in France; and Holland thought of nothing but discarding the old philosophy, and following his. Voetius being chosen rector of the university of Utrecht, procured his philosophy to be prohibited, and wrote against him; but he immediately published a vindication of himself. In 1647, he took a journey into France, where the king settled a pension of 3000 livres upon him. Christina, queen of Sweden, having invited him into that kingdom, he went thither, where he was received with the greatest civility by her majesty, who engaged him to attend her every morning at five o'clock, to instruct her in philosophy, and desired him to revise and digest all his writings which were unpublished, and to form a complete body of philosophy from them. She likewise proposed to allow him a revenue, and to form an academy of which he was to be the director. But these designs were broken off by his death in 1650. His body was interred at Stockholm, and 17 years afterwards removed to Paris, where a magnificent monument was erected to him in the church of St Genevieve du Mont. The great Dr Halley, in a paper concerning optics, observes, that though some of the ancients mention refraction as an effect of transparent mediums, Des Cartes was the first who discovered the laws of refraction, and reduced dioptrics to a science. As to his philosophy, Dr Keil, in his introduction to his examination of Dr Burnet's theory of the earth, says, that Des Cartes was so far from applying geometry to natural philosophy, that his whole system is one continued blunder on account of his negligence in that point; the laws observed by the planets in their revolutions round the sun, not agreeing with his theory of vortices. His philosophy has accordingly given way to the more accurate discoveries and demonstrations of the Newtonian system.

Cartesians, Carthage.

CARTESIANS, a sect of philosophers, who adhered to the system of Des Cartes, founded on the two following principles, the one metaphysical, the other physical. The metaphysical one is, *I think, therefore I am*: the physical principle is, that *nothing exists but substance*. Substance he makes of two kinds; the one a substance that thinks, the other a substance extended; whence actual thought, and actual extension, are the essence of substance.

The essence of matter being thus fixed in extension, the Cartesians conclude that there is no vacuum, nor any possibility thereof in nature; but that the universe is absolutely full: mere space is excluded by this principle; because extension being implied in the idea of space, matter is so too. Upon these principles, the Cartesians explained mechanically how the world was formed, and how the present celestial phenomena came to take place. See ASTRONOMY, n° 252.

CARTHAGE, a famed city of Antiquity, the capital of Africa Propria; and which, for many years, disputed with Rome the sovereignty of the world. 1
According to Velleius Paterculus, this city was built 65, according to Justin and Trogus 72, according to others 100 or 140 years before the foundations of Rome were laid. It is on all hands agreed that the Phœnicians were the founders. When founded.

The beginning of the Carthaginian history, like that of all other nations, is obscure and uncertain. In the 7th year of Pygmalion king of Tyre, his sister Elisa, or Dido, is said to have fled, with some of her companions and vassals, from the cruelty and avarice of her brother Sichæus. 2 Elisa, or Dido, escapes from her brother.

She first touched at the island of Cyprus, where she met with a priest of Jupiter, who was desirous of attending her; to which she readily consented, and fixed the priesthood in his family. At that time, it was a custom in the island of Cyprus, for the young women to go on certain stated days, before marriage, to the sea-side, there to look for strangers, that might possibly arrive on their coasts, in order to prostitute themselves for gain, that they might thereby acquire a dowry. Out of these, the Tyrians selected 80, whom they carried along with them. From Cyprus they sailed directly for the coast of Africa; and at last safely landed in the province called *Africa Propria*, not far from Uttica, a Phœnician city of great antiquity. The inhabitants received their countrymen with great demonstrations of joy, and invited them to settle among them. The common fable is, that the Phœnicians imposed upon the Africans in the following manner: They desired, for their intended settlement, only as much ground as an ox's hide would encompass. This request the Africans laughed at: but were surprised, when, upon their granting it, they saw Elisa cut the hide into the smallest shreds, by which means it surrounded a large territory; in which she built the citadel called *Byrsa*. The learned, however, are now un- 3 Builds the citadel Byrsa.

animous in exploding this fable; and it is certain that the Carthaginians for many years paid an annual tribute to the Africans for the ground they possessed.

The new city soon became populous and flourishing, by the accession of the neighbouring Africans, who came thither at first with a view of traffic. In a short time it became so considerable, that *Jarbas*, a neighbouring prince, thought of making himself master of it without any effusion of blood. In order to this, he desired that an embassy of ten of the most noble Carthaginians might be sent him; and, upon their arrival, proposed to them a marriage with Dido, threatening war in case of a refusal. The ambassadors, being afraid to deliver this message, told the queen that Jarbas desired some person might be sent him who was capable of civilizing his Africans; but that there was no possibility of finding any of her subjects who would leave his relations for the conversation of such barbarians. For this they were reprimanded by the queen; who told them that they ought to be ashamed of refusing to live in any manner for the benefit of their country. Upon this, they informed her of the true nature of their message from Jarbas; and that, according to her own decision, she ought to sacrifice herself for the good of her country. The unhappy queen, rather than submit to be the wife of such a barbarian, caused a funeral pile to be erected, and put an end to her life with a dagger.

4
**She kills herself.**

This is Justin's account of the death of Queen Dido, and is the most probable; Virgil's story of her amour with Æneas, being looked upon as fabulous, even in the days of Macrobius, as we are informed by that historian. How long monarchical government continued in Carthage, or what happened to this state in its infancy, we are altogether ignorant, by reason of the Punic Archives being destroyed by the Romans; so that there is a chasm in the Carthaginian history for above 300 years. It, however, appears, that from the very beginning, the Carthaginians applied themselves to maritime affairs, and were formidable by sea in the time of Cyrus and Cambyses. From Diodorus Siculus and Justin, it appears, that the principal support of the Carthaginians were the mines of Spain, in which country they seem to have established themselves very early. By means of the riches drawn from these mines, they were enabled to equip such formidable fleets as we are told they fitted out in the time of Cyrus or Cambyses. Justin insinuates, that the first Carthaginian settlement in Spain happened when the city of Gades, now Cadis, was but of late standing, or even in its infancy. The Spaniards finding this new colony begin to flourish, attacked it with a numerous army, insomuch that the inhabitants were obliged to call in the Carthaginians to their aid. The latter very readily granted their request, and not only repulsed the Spaniards, but made themselves masters of almost the whole province in which their new city stood. By this success, they were encouraged to attempt the conquest of the whole country: but having to do with very warlike nations, they could not push their conquests to any great length at first; and it appears from the accounts of Livy and Polybius, that the greatest part of Spain remained unsubdued till the times of Hamilcar, Asdrubal, and Hannibal.

5
**Spanish mines of vast service to the Carthaginians.**

About 503 years before the birth of Christ, the Carthaginians entered into a treaty with the Romans. It related chiefly to matters of navigation and commerce. From it we learn, that the whole island of Sardinia, and part of Sicily, were then subject to Carthage; that they were very well acquainted with the coasts of Italy, and had made some attempts upon them before this time; and that, even at this early period, a spirit of jealousy had taken place between the two republics. Some time near this period, the Carthaginians had a mind to discontinue the tribute they had hitherto paid the Africans for the ground on which their city stood. But, notwithstanding all their power, they were at present unsuccessful; and at last were obliged to conclude a peace, one of the articles of which was, that the tribute should be continued.

6
**First treaty between Carthage and Rome.**

By degrees the Carthaginians extended their power over all the islands in the Mediterranean, Sicily excepted; and for the entire conquest of this, they made vast preparations, about 480 years before Christ. Their army consisted of 300,000 men; their fleet was composed of upwards of 2000 men of war, and 3000 transports; and with such an immense armament, they made no doubt of conquering the whole island in a single campaign. In this, however, they found themselves miserably deceived. Hamilcar their general having landed his numerous forces, invested Himera, a city of considerable importance. He carried on his attacks with the greatest assiduity; but was at last attacked in his trenches by Gelon and Theron, the tyrants of Syracuse and Agrigentum, who gave the Carthaginians one of the greatest overthrows mentioned in history. An hundred and fifty thousand were killed in the battle and pursuit, and all the rest taken prisoners; so that of so mighty an army, not a single person escaped. Of the 2000 ships of war and 3000 transports, of which the Carthaginian fleet consisted, eights ships only, which then happened to be out at sea, made their escape: these immediately set sail for Carthage; but were all cast away, and every soul perished, except a few who were saved in a small boat, and at last reached Carthage with the dismal news of the total loss of the fleet and army. No words can express the consternation of the Carthaginians upon receiving the news of so terrible a disaster. Ambassadors were immediately dispatched to Sicily, with orders to conclude a peace upon any terms. They put to sea without delay; and landing at Syracuse, threw themseves at the conqueror's feet. They begged Gelon, with many tears, to receive their city into favour, and grant them a peace on whatever terms he should choose to prescribe. He granted their request upon condition that Carthage should pay him 2000 talents of silver to defray the expences of the war; that they should build two temples, where the articles of the treaty should be lodged and kept as sacred; and that for the future they should abstain from human sacrifices. This was not thought a dear purchase of a peace for which there was such occasion; and to show their gratitude for Gelon's moderation, the Carthaginians complimented his wife Demarata with a crown of gold worth 100 talents.

7
**Sicily invaded by the Carthaginians.**

8
**They are utterly destroyed.**

9
**Peace concluded.**

From this time we find little mention of the Carthaginians for 70 years. Some time during this period, however, they had greatly extended their dominions

Carthage. minions in Africa, and likewise shaken off the tribute which gave them so much uneasiness. They had warm disputes with the inhabitants of Cyrene the capital of Cyrenaica, about a regulation of the limits of their respective territories. The consequence of these disputes was a war, which reduced both nations so low, that they agreed first to a cessation of arms, and then to a peace. At last it was agreed, that each state should appoint two commissaries, who should set out from their respective cities on the same day, and that the spot on which they met should be the boundary of both states. In consequence of this, two brothers called *Philæni* were sent out from Carthage, who advanced with great celerity, while those from Cyrene were much more slow in their motions. Whether this proceeded from accident or design, or perfidy, we are not certainly informed; but, be this as it will, the Cyreneans finding themselves greatly outstripped by the Philæni, accused them of breach of faith, asserting that they had set out before the time appointed, and consequently that the convention between their principals was broken. The Philæni desired them to propose some expedient whereby their differences might be accommodated; promising to submit to it, whatever it might be. The Cyreneans then proposed, either that the Philæni should retire from the place where they were, or that they should be buried alive upon the spot. With this last condition the brothers immediately complied, and by their death gained a large extent of territory to their country. The Carthaginians ever after celebrated this as a most brave and heroic action; paid them divine honours; and endeavoured to immortalize their names by erecting two altars there, with suitable inscriptions upon them.

10 Dispute with the Cyreneans

11 Story of the *Philæni*.

12 Sicily invaded anew.

About the year before Christ 412, some disputes happening between the Egestines and Selinuntines, inhabitants of two cities in Sicily, the former called in the Carthaginians to their assistance; and this occasioned a new invasion of Sicily by that nation. Great preparations were made for this war; Hannibal, whom they had appointed general, was empowered to raise an army equal to the undertaking, and equip a suitable fleet. They also appointed certain funds for defraying all the expences of the war, intending to exert their whole force to reduce the island under their subjection.

13 Emporium and Selinus taken.

The Carthaginian general having landed his forces, immediately marched for Selinus. In his way he took Emporium, a town situated on the river Mazara; and having arrived at Selinus, he immediately invested it. The besieged made a very vigorous defence; but at last the city was taken by storm, and the inhabitants were treated with the utmost cruelty. All were massacred by the savage conquerors, except the women who fled to the temples; and these escaped, not through the merciful disposition of the Carthaginians, but because they were afraid, that if driven to despair they would set fire to the temples, and by that means consume the treasure they expected to find in those places. Sixteen thousand were massacred; 2250 escaped to Agrigentum; and the women and children, about 5000 in number, were carried away captives. At the same time the temples were plundered, and the city rased to the ground.

Carthage. 14 As likewise Himera.

After the reduction of Selinus, Hannibal laid siege to Himera; that city he desired above all things to become master of, that he might revenge the death of his grandfather Hamilcar, who had been slain before it by Gelon. His troops, flushed with their late success, behaved with undaunted courage; but finding his battering engines not to answer his purpose sufficiently, he undermined the wall, supporting it with large beams of timber, to which he afterwards set fire, and thus laid part of it flat on the ground. Notwithstanding this advange, however, the Carthaginians were several times repulsed with great slaughter; but at last they became masters of the place, and treated it in the same manner as they had done Selinus. After this, Hannibal, dismissing his Sicilian and Italian allies, returned to Africa.

The Carthaginians were now so much elated, that they meditated the reduction of the whole island. But as the age and infirmities of Hannibal rendered him incapable of commanding the forces alone, they joined in commission with him Imilcar the son of Hanno, one of the same family. On the landing of the Carthaginian army, all Sicily was alarmed, and the principal cities put themselves into the best state of defence they were able. The Carthaginians immediately marched to Agrigentum, and began to batter the walls with great fury. The besieged, however, defended themselves with incredible resolution, in a sally burnt all the machines raised against their city, and repulsed the enemy with great slaughter. The Syracusians in the mean time, being alarmed at the danger of Agrigentum, sent an army to its relief. On their approach they were immediately attacked by the Carthaginians; but after a sharp dispute the latter were defeated and forced to fly to the very walls of Agrigentum, with the loss of 6000 men. Had the Agrigentine commanders now sallied out, and fallen upon the fugitives, in all probability the Carthaginian army must have been destroyed; but either through fear or corruption, they refused to stir out of the place, and this occasioned the loss of it. Immense booty was found in the city; and the Carthaginians behaved with their usual cruelty, putting all the inhabitants to the sword, not excepting even those who had fled to the temples.

15 Agrigentum besieged;

16 And taken.

The next attempt of the Carthaginians was designed against the city of Gela: but the Geleans, being greatly alarmed, implored the protection of Syracuse; and, at their request, Dionysius was sent to assist them with 2000 foot and 400 horse. The Geleans were so well satisfied with his conduct, that they treated him with the highest marks of distinction; they even sent ambassadors to Syracuse to return thanks for the important services done them by sending him thither; and soon after he was appointed generalissimo of the Syracusian forces and those of their allies against the Carthaginians. In the mean time Imilcar, having rased the city of Agrigentum, made an incursion into the territories of Gela and Comarina; which having ravaged in a dreadful manner, he carried off such immense quantity of plunder, as filled his whole camp. He then marched against the city: but though it was but indifferently fortified, he met with a very vigorous resistance; and the place held out for a long time without receiving any assistance from its allies.

17 Gela besieged.

2 At

Carthage. At last Dionysius came to its assistance with an army of 50,000 foot and 1000 horse. With these he attacked the Carthaginian camp, but was repulsed with great loss: after which, he called a council of war, the result of whose deliberations was, that since the enemy was so much superior to them in strength, it would be highly imprudent to put all to the issue of a battle; and therefore, that the inhabitants should be persuaded to abandon the country, as the only means of saving their lives. In consequence of this, a trumpet was sent to Imilcar to desire a cessation of arms till the next day, in order, as was pretended, to bury the dead, but in reality to give the people of Gela an opportunity of making their escape. Towards the beginning of the night the bulk of the citizens left the place; and he himself with the army followed them about midnight. To amuse the enemy, he left 2000 of his light armed troops behind him, commanding them to make fires all night, and set up loud shouts as though the army still remained in town. At day-break these took the same route as their companions, and pursued their march with great celerity. The Carthaginians finding the city deserted by the greatest part of its inhabitants, immediately entered it, putting to death all who had remained; after which, Imilcar having thoroughly plundered it, moved towards Camarina. The inhabitants of this city had been likewise drawn off by Dionysius, and it underwent the same fate with Gela.

18 Abandoned by its inhabitants.

19 Peace concluded.

Notwithstanding these successes, however, Imilcar finding his army greatly weakened, partly by the casualties of war, and partly by a plague which broke out in it, sent a herald to Syracuse to offer terms of peace. His unexpected arrival was very agreeable to the Syracusians, and a peace was immediately concluded upon the following terms, *viz.* That the Carthaginians, besides their ancient acquisitions in Sicily, should still possess the countries of the Silicani, the Selinuntines, the Himereans, and Agrigentines: that the people of Gela and Camarina should be permitted to reside in their respective cities, which yet should be dismantled, upon their paying an annual tribute to the Carthaginians; that all the other Sicilians should preserve their independency except the Syracusians, who should continue in subjection to Dionysius.

20 Dionysius breaks the treaty.

The tyrant of Syracuse, however, had concluded this peace with no other view than to gain time, and to put himself in a condition to attack the Carthaginian territories with greater force. Having accomplished this, he acquainted the Syracusians with his design, and they immediately approved of it; upon which he gave up to the fury of the populace the persons and possessions of the Carthaginians who resided in Syracuse, and traded there on the faith of treaties. As there were many of their ships at that time in the harbour, laden with cargoes of great value, the people immediately plundered them; and, not content with this, ransacked all their houses in a most outrageous manner. This example was followed throughout the whole island; and in the mean time Dionysius dispatched a herald to Carthage with a letter to the senate and people, telling them, that if they did not immediately withdraw their garrisons from all the Greek cities in Sicily, the people of Syracuse would treat them as enemies. With this demand, however, he did not allow them to comply; for without waiting for any answer from Carthage, he advanced with his army to Mount Eryx, near which stood the city of Motya, a Carthaginian colony of great importance, and this he immediately invested. But soon after, leaving his brother Leptines to carry on the attacks, he himself went with the greatest part of his forces to reduce the cities in alliance with the Carthaginians. He destroyed their territories with fire and sword, cut down all their trees; and then he sat down before Egesta and Entella, most of the other towns having opened their gates at his approach; but these baffling his utmost efforts, he returned to Motya, and pushed on the siege of that place with the utmost vigour.

21 Syracusian ships destroyed.

The Carthaginians, in the mean time, though alarmed at the message sent them by Dionysius, and though reduced to a miserable situation by the plague which had broken out in their city, did not despond, but sent officers to Europe, with considerable sums, to raise troops with the utmost diligence. Ten gallies were also sent from Carthage to destroy all the ships that were found in the harbour of Syracuse. The admiral, according to his orders, entered the harbour in the night, without being discerned by the enemy; and having sunk most of the ships he found there, returned without the loss of a man.

22 Motya taken by the Greeks.

All this while the Motyans defended themselves with incredible vigour: while their enemies, desirous of revenging the cruelties exercised upon their countrymen by the Carthaginians; fought like lions. At last the place was taken by storm, and the Greek soldiers began a general massacre. For some time Dionysius was not able to restrain their fury: but at last he proclaimed that the Motyans should fly to the Greek temples; which they accordingly did, and a stop was put to the slaughter; but the soldiers took care thoroughly to plunder the town, in which they found a great treasure.

The following spring, Dionysius invaded the Carthaginian territories, and made an attempt upon Egeste; but here he was again disappointed. The Carthaginians were greatly alarmed at his progress; but, next year, notwithstanding a considerable loss sustained in a sea-fight with Leptines, Himilco their general landed a powerful army at Panormus, seized upon Eryx, and then advancing towards Motya, made himself master of it, before Dionysius could send any forces to its relief. He next advanced to Messana, which he likewise besieged and took; after which most of the Siculi revolted from Dionysius.

23 Greeks defeated at sea by the Carthaginians.

Notwithstanding this defection, Dionysius, finding his forces still amount to 30,000 foot and 3000 horse, advanced against the enemy. At the same time, Leptines was sent with the Syracusian fleet against that of the Carthaginians, but with positive orders not to break the line of battle upon any account whatever. But, notwithstanding these orders, he thought proper to divide his fleet, and the consequence of this was a total defeat; above 100 of the Syracusian galleys being sunk or taken, and 20,000 of their men killed in the battle or in the pursuit. Dionysius disheartened by this misfortune, returned with his army to Syracuse, being afraid that the Carthagenian fleet might become masters of that city, if he should advance to fight the land army. Himilco did not fail immediately to invest the capital:

24 Syracuse besieged by the Carthaginians.

Carthage. capital; and had certainly become maſter of it, and conſequently of the whole iſland, had not a moſt malignant peſtilence obliged him to deſiſt from all further operations. This dreadful malady made great havock among his forces both by ſea and land; and to complete his misfortunes, Dionyſius attacked him unexpectedly, totally ruined his fleet, and made himſelf maſter of his camp.

25 Himilco obliged to return. Himilco finding himſelf altogether unable to ſuſtain another attack, was obliged to come to a private agreement with Dionyſius; who for 300 talents conſented to let him eſcape to Africa, with the ſhattered remains of his fleet and army. The unfortunate general arrived at Carthage, clad in mean and ſordid attire, where he was met by a great number of people bewailing their ſad and inauſpicious fortune. Himilco joined them in their lamentations; and being unable to ſurvive his misfortunes, put an end to his own life. He had left Mago in Sicily, to take care of the Carthaginian intereſts in the beſt manner he could. In order to this, Mago treated all the Sicilians ſubject to Carthage with the greateſt humanity; and having received a conſiderable number of ſoldiers from Africa, he at laſt formed an army with which he ventured a battle: in this he was defeated, and driven out of the field, with the loſs of 800 men; which obliged him to deſiſt from farther attempts of that nature.

26 Another invaſion of Sicily. Notwithſtanding all theſe terrible diſaſters, the Carthaginians could not forbear making new attempts upon the iſland of Sicily; and about the year before Chriſt 392, Mago landed in it with an army of 80,000 men. This attempt, however, was attended with no better ſucceſs than before; Dionyſius found means to reduce him to ſuch ſtraits for want of proviſions, that he was obliged to ſue for peace. This continued for nine years, at the end of which the war was renewed with various ſucceſs. It continued with little interruption till the year before Chriſt 367, when, the Syracuſian ſtate being rent by civil diſſentions, the Carthaginians thought it a proper time to exert themſelves, in order to become maſters of the whole iſland. They fitted out a great fleet, and entered into alliance with Icetas, tyrant of Leontini, who pretended to have taken Syracuſe under his protection. By this treaty, the two powers engaged to aſſiſt each other, in order to expel Dionyſius II. after which they were to divide the iſland between them.

27 Syracuſians aſſiſted by the Corinthians. The Syracuſians applied for ſuccours to the Corinthians; and they readily ſent them a body of troops under the command of Timoleon an experienced general. By a ſtratagem, he got his forces landed at Taurominium. The whole of them did not exceed 1200 in number: yet with theſe he marched againſt Icetas, who was at the head of 5000 men; his army he ſurpriſed at ſupper, put 300 of them to the ſword, and took 600 priſoners. He then marched to Syracuſe, and broke into one part of the town before the enemy had any notice of his approach: here he took poſt, and defended himſelf with ſuch reſolution, that he could not be diſlodged by the united power of Icetas and the Carthaginians.

28 Fooliſh conduct of the Carthaginian admiral. In this place he remained for ſome time, in expectation of a reinforcement from Corinth; till the arrival of which, he did not judge it practicable to extend his conqueſts.—The Carthaginians being appriſed that the Corinthian ſuccours were detained by tempeſtuous weather at Thurium, poſted a ſtrong ſquadron, under Hanno their admiral, to intercept them in their paſſage to Sicily. But that commander, not imagining the Corinthians would attempt a paſſage to Sicily in ſuch a ſtormy ſeaſon, left his ſtation at Thurium, and ordering his ſeamen to crown themſelves with garlands, and adorn their veſſels with bucklers both of the Greek and Carthaginian form, ſailed to Syracuſe in a triumphant manner. Upon his arrival there, he gave the troops in the citadel to underſtand, that he had taken the ſuccours Timoleon expected, thinking by this means to intimidate them to ſurrender. But, while he thus trifled away his time, the Corinthians marched with great expedition to Rhegium, and, taking the advantage of a gentle breeze, were eaſily wafted over into Sicily. 29 Cowardice of Mago. Mago, the Carthaginian general, was no ſooner informed of the arrival of this reinforcement, than he was ſtruck with terror, though the whole Corinthian army did not exceed 4000 men; and, ſoon after, fearing a revolt of his mercenaries, he weighed anchor, in ſpite of all the remonſtrances of Icetas, and ſet ſail for Africa. Here he no ſooner arrived, than, overcome with grief and ſhame for his unparalleled cowardice, he laid violent hands on himſelf. His body was hung upon a gallows or croſs, in order to deter ſucceeding generals from forfeiting their honour in ſo flagrant a manner.

30 Exploits of Timoleon. After the flight of Mago, Timoleon carried all before him. He obliged Icetas to renounce his alliance with the ſtate of Carthage, and even depoſed him, and continued his military preparations with the greateſt vigour. On the other hand, the Carthaginians prepared for the enſuing campaign with the greateſt alacrity. An army of 70,000 men was ſent over, with a fleet of 200 ſhips of war, and 1000 tranſports laden with warlike engines, armed chariots, horſes, and all other ſorts of proviſions. This immenſe multitude, however, was overthrown on the banks of the Crimeſus by Timoleon: 10,000 were left dead on the field of battle; and of theſe, above 3000 were native Carthaginians of the beſt families in the city. Above 15,000 were taken priſoners; all their baggage and proviſions, with 200 chariots, 1000 coats of mail, and 10,000 ſhields, fell into Timoleon's hands. The ſpoil, which conſiſted chiefly of gold and ſilver, was ſo immenſe, that the whole Sicilian army was three days in collecting it and ſtripping the ſlain. After this ſignal victory, he left his mercenary forces upon the frontiers of the enemy, to plunder and ravage the country; while he himſelf returned to Syracuſe with the reſt of his army, where he was received with the greateſt demonſtrations of joy. Soon after, Icetas, grown weary of his private ſtation, concluded a new peace with the Carthaginians; and, having aſſembled an army, ventured an egagement with Timoleon: but in this he was utterly defeated; and himſelf, with Eupolemus his ſon, and Euthymus general of his horſe, were brought bound to Timoleon by their own ſoldiers. The two firſt were immediately executed as tyrants and traitors, and the laſt murdered in cold blood; Icetas's wives and daughters were likewiſe cruelly put to death after a public trial. In a ſhort time after, Mamercus, another of the Carthaginian confederates, was over

Carthage. overthrown by Timoleon, with the loss of 2000 men. These misfortunes induced the Carthaginians to conclude a peace on the following terms: That all the Greek cities should be set free; that the river Halycus should be the boundary between the territories of both parties; that the natives of the cities subject to the Carthaginians should be allowed to withdraw, if they pleased, to Syracuse, or its dependencies, with their families and effects; and lastly, that Carthage should not, for the future, give any assistance to the remaining tyrants against Syracuse.

31 Peace concluded.

32 War renewed

About 316 years before Christ, we find the Carthaginians engaged in another bloody war with the Sicilians, on the following occasion. Sosistratus, who had usurped the supreme authority at Syracuse, having been forced by Agathocles to raise the siege of Rhegium, returned with his shattered troops to Sicily. But soon after this unsuccessful expedition, he was obliged to abdicate the sovereignty and quit Syracuse. With him were expelled above 600 of the principal citizens, who were suspected of having formed a design to overturn the plan of government which then prevailed in the city. As Sosistratus and the exiles thought themselves ill treated, they had recourse to the Carthaginians, who readily espoused their cause. Hereupon the Syracusians having recalled Agathocles, who had before been banished by Sosistratus, appointed him commander in chief of all their forces, principally on account of the known aversion he bore that tyrant. The war, however, did not then continue long; for Sosistratus and the exiles were quickly received again into the city, and peace was concluded with Carthage: the people of Syracuse, however, finding that Agathocles wanted to make himself absolute, exacted an oath from him, that he would do nothing to the prejudice of the democracy. But, notwithstanding this oath, Agathocles pursued his purpose, and by a general massacre of the principal citizens of Syracuse raised himself to the throne. For some time he was obliged to keep the peace he had concluded with Carthage; but at last finding his authority established, and that his subjects were ready to second his ambitious designs, he paid no regard to his treaties, but immediately made war on the neighbouring states, which he had expresly agreed not to do, and then carried his arms into the very heart of the island. In these expeditions he was attended with such success, that in two years time he brought into subjection all the Greek part of Sicily. This being accomplished, he committed great devastations in the Carthaginian territories, their general Hamilcar not offering to give him the least disturbance. This perfidious conduct greatly incensed the people of those dristricts against Hamilcar, whom they accused before the senate. He died, however, in Sicily; and Hamilcar the son of Gisco was appointed to succeed him in the command of the forces. The last place that held out against Agathocles was Messana, whither all the Syracusian exiles had retired. Pasiphilus, Agathocles's general, found means to cajole the inhabitants into a treaty; which Agathocles, according to custom, paid no regard to, but as soon as he was in possession of the town, cut off all those who had opposed his government. For, as he intended to prosecute the war with the utmost vigour against Carthage, he thought it a point of good policy to destroy as many of his Sicilian enemies as possible.

33 Agathocles raises himself to the throne of Syracuse.

The Carthaginians in the mean time having landed a powerful army in Sicily, an engagement soon ensued, in which Agathocles was defeated with the loss of 7000 men. After this defeat he was obliged to shut himself up in Syracuse, which the Carthaginians immediately invested, and most of the Greek states in the island submitted to them.

34 Defeated by the Carthaginians, and besieged in Syracuse.

Agathocles seeing himself stripped of almost all his dominions, and his capital itself in danger of falling into the hands of the enemy, formed a design which, were it not attested by writers of undoubted authority, would seem absolutely incredible. This was no less than to transfer the war into Africa, and lay siege to the enemy's capital, at a time when he himself was besieged, and only one city left to him in all Sicily. Before he departed, however, he made all the necessary preparations for the defence of the place, and appointed his brother Antandrus governor of it. He also gave permission to all who were not willing to stand the fatigues of a siege to retire out of the city. Many of the principal citizens, Justin says 1600, accepted of this offer; but they were no sooner got out of the place, than they were cut off by parties posted on the road for that purpose. Having seized upon their estates, Agathocles raised a considerable sum, which was intended in some measure to defray the expence of the expedition; however, he carried with him only 50 talents to supply his present wants, being well assured that he should find in the enemy's country whatever was necessary for his subsistence. As the Carthaginians had a much superior fleet, they for some time kept the mouth of the harbour blocked up: but at last a fair opportunity offered; and Agathocles hoisting sail, by the activity of his rowers soon got clear both of the port and city of Syracuse. The Carthaginians pursed him with all possible expedition; but, notwithstanding their utmost efforts, Agathocles got his troops landed with very little opposition.

35 He invades Africa.

Soon after his forces were landed, Agathocles burnt his fleet, probably that his soldiers might behave with the greater resolution, as they saw no possibility of flying from their danger. He first advanced to a place called the Great City. This, after a feeble resistance, he took and plundered. From hence he marched to Tunis, which surrendered on the first summons; and Agathocles levelled both places with the ground.

36 He burns his fleet.

The Carthaginians were at first thrown into the greatest consternation; but soon recovering themselves, the citizens took up arms with so much alacrity, that in a few days they had on foot an army of 40,000 foot and 1000 horse, with 2000 armed chariots. The command of this army they entrusted to Hanno and Bomilcar, two generals between whom there subsisted a great animosity. This occasioned the defeat of their whole army with the loss of their camp, though all the forces of Agathocles did not exceed 14,000 in number. Among other rich spoils the conqueror found many chariots of curious workmanship, which carried 20,000 pair of fetters and manacles that the enemy had provided for the Sicilian prisoners. After this defeat, the Carthaginians, supposing themselves to have fallen under the displeasure of their deities on account of their neglecting to sacrifice children of noble families

37 Carthaginians defeated.

38 Their method of appeasing their deities.

Carthage.

lies to them, resolved to expiate this guilt. Accordingly 200 children of the first rank were sacrificed to their bloody gods, besides 300 other persons who voluntarily offered themselves to pacify the wrath of these deities.

39 Hamilcar makes an assault on Syracuse.

After these expiations, Hamilcar was recalled from Sicily. When the messengers arrived, Hamilcar commanded them not once to mention the victory of Agathocles; but, on the contrary, to give out among the troops that he had been entirely defeated, his forces all cut off, and his fleet destroyed by the Carthaginians. This threw the Syracusians into the utmost despair; however, one Eurymnon, an Etolian, prevailed upon Antandrus, not to consent to a capitulation, but to stand a general assault. Hamilcar being informed of this, prepared his battering engines, and made all the necessary preparations to storm the town without delay. But while matters remained in this situation, a galley, which Agathocles had caused to be built immediately after the battle, got into the harbour of Syracuse, and acquainted the inhabitants with the certainty of Agathocles's victory. Hamilcar observing that the garrison flocked down to the port on this occasion, and expecting to find the walls unguarded, ordered his soldiers to erect scaling-ladders, and begin the intended assault. The enemy having left the ramparts quite exposed, the Carthaginians mounted them without being discerned, and had almost possessed themselves of an entire part lying between two towers, when the patrol discovered them. Upon this a warm dispute ensued; but at last the Carthaginians were repulsed

40 He raises the siege.

with loss. Hamilcar, therefore, finding it in vain to continue the siege after such glad tidings had restored life and soul to the Syracusians, drew off his forces, and sent a detachment of 5000 men to reinforce the troops in Africa. He still entertained hopes, however, that he might oblige Agathocles to quit Africa, and return to the defence of his own dominions. He spent some time in making himself master of such cities as sided with the Syracusians; and after having brought all their allies under subjection, returned again to Syracuse, hoping to surprise it by an attack in the

41 Is defeated and taken prisoner and put to death.

night-time. But being attacked while advancing thro' narrow passes, where his numerous army had not room to act, he was defeated with great slaugther, and himself taken prisoner, carried into Syracuse, and put to death.

42 Agrigentines attempt the sovereignty of Sicily.

In the mean time the Agrigentines, finding that the Carthaginians and Syracusians had greatly weakened each other by this war, thought it a proper opportunity to attempt the sovereignty of the whole island. They therefore commenced a war against both parties; and prosecuted it with such success, that in a short time they wrested many places of note both out of the hands of the Syracusians and Carthaginians.

43 Success of Agathocles in Africa.

In Africa the tyrant carried every thing before him. He reduced most of the places of any note in the territory of Carthage; and hearing that Elymas king of Libya had declared against him, he immediately entered Libya Superior, and in a great battle overthrew that prince, putting to the sword a good part of his troops, and the general who commanded them; after which he advanced against the Carthaginians with such expedition, that he surprised and defeated them, with the loss of 2000 killed, and a great number taken prisoners. He next prepared for the siege of Carthage itself; and in order thereto advanced to a post within five miles of that city. On the other hand, notwithstanding the great losses they had already sustained, the Carthaginians, with a powerful army, encamped between him and their capital. In this situation Agathocles received advice of the defeat of the Carthaginian forces before Syracuse, and the head of Hamilcar their general. Upon this he immediately rode up to the enemy's camp, and showing them the head, gave them an account of the total destruction of their army before Syracuse. This threw them into such consternation, that in all human probability Agathocles would have made himself master of Carthage, had not an unexpected mutiny arisen in his camp, which gave the Carthaginians an opportunity of recovering from their terror.

44 He makes an alliance with Ophellas;

The year following an engagement happened, in which neither party gained any great advantage: but soon after the tyrant, notwithstanding all his victories, found himself unable to carry on the war alone; and therefore endeavoured to gain over to his interest Ophellas, one of the captains of Alexander the Great. In this he perfectly succeeded; and, to succour his new ally the more effectually, Ophellas sent to Athens for a body of troops. Having finished his military preparations, Ophellas found his army to consist of 10,000 foot and 600 horse, all regular troops, besides 100 chariots, and a body of 10,000 men, attended by their wives and children, as though he had been going to plant a new colony. At the head of these forces he continued his march towards Agathocles for 18 days; and then encamped at Automolæ, a city about 3000 stadia distant from the capital of his dominions. From thence he advanced through the Regio Syrtica; but found himself reduced to such extremities, that his army was in danger of perishing for want of bread, water, and other provisions. They were also greatly annoyed by serpents and wild beasts, with which that desert region abounded. The serpents made the greatest havock among the troops; for, being of the same colour with the earth, and extremely venomous, many soldiers, who trod upon them without seeing them, were stung to death. At last, after a very fatiguing march of two months, he approached Agathocles, and encamped at a small distance from him, to the no small terror of the Carthaginians, who apprehended the most fatal consequences from this

45 Whom he treacherously murders.

junction. Agathocles at first caressed him, and advised him to take all possible care of his troops that had undergone so many fatigues; but soon after cut him off by treachery, and then by fair words and promises persuaded his troops to serve under himself.

Agathocles now finding himself at the head of a numerous army, assumed the title of King of Africa, intending soon to complete his conquests by the reduction of Carthage. He began with the siege of Utica, which was taken by assault. After this he marched against Hippo Diarrhytus, the Biserta of the moderns, which was also taken by storm; and after this most of the people bordering upon the sea-coasts, and even those who inhabited the inland parts of the

46 Is obliged to return home.

country, submitted to him. But in the midst of this career of success, the Sicilians formed an association in favour

Carthage.

favour of liberty; which obliged the tyrant to return home, leaving his son Archagathus to carry on the war in Africa.

47 Success of Archagathus.

Archagathus, after his father's departure, greatly extended the African conquests. He sent Eumachus at the head of a large detachment to invade some of the neighbouring provinces, while he himself, with the greatest part of his army, observed the motions of the Carthaginians. Eumachus falling into Numidia, first took the great city of Tocas, and conquered several of the Numidian cantons. Afterwards he besieged and took Phellina; which was attended with the submission of the Asphodelodians, a nation, according to Diodorus, as black as the Ethiopians. He then reduced several cities; and being at last elated with such a run of good fortune, resolved to penetrate into the more remote parts of Africa. Here he at first met with success; but hearing that the barbarous nations were advancing in a formidable body to give him battle, he abandoned his conquests, and retreated with the utmost precipitation towards the sea-coasts, after having lost abundance of men.

48 He is reduced to the utmost distress.

This unfortunate expedition made a great alteration for the worse in the affairs of Archagathus. The Carthaginians being informed of Eumachas's bad success, resolved to exert themselves in an extraordinary manner to repair their former losses. They divided their forces into three bodies: one of these they sent to the sea-coasts, to keep the towns there in awe; another they dispatched into the Mediterranean parts, to preserve the allegiance of the inhabitants there; and the last body they ordered to the Upper Africa, to support their confederates in that country. Archagathus being apprised of the motions of the Carthaginians, divided his forces likewise into three bodies. One of these he sent to observe the Carthaginian troops on the sea-coasts, with orders to advance afterwards into the Upper Africa; another under the command of Æschrion, one of his generals, he posted at a proper distance in the heart of the country, to have an eye both on the enemy there and the barbarous nations; and with the last, which he led in person, he kept nearer Carthage, preserving a communication with the other two, in order to send them succours, or recal them, as the exigency of affairs should require.—The Carthaginian troops sent into the heart of the country, were commanded by Hanno, a general of great experience, who being informed of the approach of Æschrion, laid an ambuscude for him, into which he was drawn and cut off with 4000 foot and 200 horse. Himilco, who commanded the Carthaginian forces in Upper Africa, having advice of Eumachus's march, immediately advanced against him. An engagement ensued, in which the Greeks were almost totally cut off, or perished with thirst after the battle, out of 8000 foot only 30, and of 800 horse only 40, having the good fortune to make their escape.

Archagathus receiving the melancholy news of these two defeats, immediately called in the detachments he had sent out to harass the enemy, which would otherwise have been instantly cut off. He was, however, in a short time hemmed in on all sides in such a manner as to be reduced to the last extremity for want of provisions, and ready every moment to be swallowed up by the numerous forces which surrounded him. In this deplorable situation Agathocles received an express from Archagathus, acquainting him of the losses he had sustained, and the scarcity of provisions he laboured under. Upon this the tyrant, leaving the care of the Sicilian war to one Leptines, by a stratagem got 18 Etruscan ships that came to his assistance out of the harbour; and then engaging the Carthaginian squadron which lay in its neighbourhood, took five of their ships, and made all their men prisoners. By this means he became master of the port, and secured a passage into it for the merchants of all nations, which soon restored plenty to that city, where the famine before had begun to make great havock. Supplying himself, therefore, with a sufficient quantity of necessaries for the voyage he was going to undertake, he immediately set sail for Africa.

Upon his arrival in this country, Agathocles reviewed his forces, and found them to consist of 6000 Greeks, as many Samnites, Celtes, and Etruscans; besides 10,000 Africans, and 1500 horse. As he found his troops almost in a state of despair, he thought this a proper time for offering the enemy battle. The Carthaginians, however, did not think proper to accept the challenge; especially as by keeping close in their camp, where they had plenty of every thing, they could starve the Greeks to a surrender without striking a stroke. Upon this Agathocles attacked the Carthaginian camp with great bravery, made a considerable impression upon it, and might perhaps have carried it, had not his mercenaries deserted him almost at the first onset. By this piece of cowardice he was forced to retire with precipitation to his camp, whither the Carthaginians pursued him very closely, doing great execution in the pursuit.

49 Agathocles arrives in Africa.

50 Attacks the camp of the enemy without success.

The next night, the Carthaginians sacrificed all the prisoners of distinction as a greatful acknowledgment to the gods for the victory they had gained. While they were employed in the inhuman work, the wind, suddenly rising, carried the flames to the sacred tabernacle near the altar, which was entirely consumed, as well as the general's tent, and those of the principal officers adjoining to it. A dreadful alarm took place through the whole camp, which was heightened by the great progress the fire made. For the soldiers tents consisting of very combustible materials, and the wind blowing in a most violent manner, the whole camp was almost entirely laid in ashes; and many of the soldiers endeavouring to carry off their arms, and the rich baggage of their officers, perished in the flames. Some of those who made their escape met with a fate equally unhappy: For, after Agathocles had received the last blow, the Africans deserted him, and were in that instant coming over in a body to the Carthaginians. These, the persons who were flying from the flames took to be the whole Syracusian army advancing in order of battle to attack their camp. Upon this a dreadful confusion ensued. Some took to their heels; others fell down in heaps one upon another; and others engaged their comrades, mistaking them for the enemy. Five thousand men lost their lives in this tumult, and the rest thought proper to take refuge within the walls of Carthage; nor could the appearance of day-light, for some time, dissipate

51 Disaster in the Carthaginian camp.

 ſipate their terrible apprehenſions. In the mean time, the African deſerters, obſerving the great confuſion the Carthaginians were in, and not knowing the meaning of it, were ſo terrified, that they thought proper to return to the place from whence they came.

52 Another in that of Agathocles.

The Syracuſians ſeeing a body of troops advancing towards them in good order, concluded that the enemy were marching to attack them, and therefore immediately cried out "To arms." The flames aſcending out of the Carthaginian camp into the air, and the lamentable outcries proceeding from thence, confirmed them in this opinion, and greatly heightened their confuſion. The conſequence was much the ſame as in the Carthaginian camp; for coming to blows with one another inſtead of the enemy, they ſcarce recovered their ſenſes upon the return of light, and the inteſtine fray was ſo bloody, that it coſt Agathocles 4000 men.

53 He eſcapes privately.

This laſt diſaſter ſo diſheartened the tyrant, that he immediately ſet about contriving means for making his eſcape privately; and this he at laſt, though with great difficulty, effected. After his departure, his two ſons were immediately put to death by the ſoldiers, who, chooſing a leader from among themſelves, made peace with the Carthaginians upon the following conditions: 1. That the Greeks ſhould deliver up all the places they held in Africa, receiving from them 300 talents; 2. That ſuch of them as were willing to ſerve in the Carthaginian army ſhould be kindly treated, and receive the uſual pay; and, 3. That the reſt ſhould be tranſported to Sicily, and have the city of Selinus for their habitation.

54 Cauſes of the firſt Punic War.

From this time, to that of the firſt war with the Romans, we find nothing remarkable in the hiſtory of the Carthaginians. The firſt Punic war, as it is commonly called, happened about 256 years before Chriſt. At that time, the Carthaginians were poſſeſſed of extenſive dominions in Africa; they had made conſiderable progreſs in Spain; were maſters of Sardinia, Corſica, and all the iſlands on the coaſt of Italy; and had extended their conqueſts to a great part of Sicily. The occaſion of the firſt rupture between the two republics was as follows. The Mamertines being vanquiſhed in battle, and reduced to great ſtraits by Hiero king of Syracuſe, had reſolved to deliver up Meſſina, the only city they now poſſeſſed, to that prince, with whoſe mild government and ſtrict probity they were well acquainted. Accordingly, Hiero was advancing at the head of his troops to take poſſeſſion of the city, when Hannibal, who at that time commanded the Carthaginian army in Sicily, prevented him by a ſtratagem. He came to meet Hiero, as it were to congratulate him on his victory; and amuſed him while ſome of the Carthaginian troops filed off towards Meſſina. Hereupon the Mamertines, ſeeing their city ſupported by a new reinforcement, were divided into ſeveral opinions. Some were for accepting the protection of Carthage; others were for ſurrendering to the king of Syracuſe; but the greater part were for calling in the Romans to their aſſiſtance. Deputies were accordingly diſpatched to Rome, offering the poſſeſſion of the city to the Romans, and in the moſt moving terms imploring protection. This, after ſome debate, was agreed to; and the conſul Appius Claudius received orders to attempt a paſſage to Sicily, at the head of a powerful army. Being obliged to ſtay ſome time at Rome, however, one Caius Claudius, a perſon of great intrepidity and reſolution, was diſpatched with a few veſſels to Rhegium. On his arrival there, he obſerved the Carthaginian ſquadron to be ſo much ſuperior to his own, that he thought it would be little better than madneſs to attempt at that time to tranſport forces to Sicily. He croſſed the ſtraits, however, and had a conference with the Mamertines, in which he prevailed upon them to accept of the protection of Rome; and on this he made the neceſſary preparations for tranſporting his forces. The Carthaginians being informed of the reſolutions of the Romans, ſent a ſtrong ſquadron of galleys under the command of Hanno, to intercept the Roman fleet; and accordingly the Carthaginian admiral, coming up with them near the coaſt of Sicily, attacked them with great fury. During the engagement a violent ſtorm aroſe, which daſhed many of the Roman veſſels againſt the rocks, and did a vaſt deal of damage to their ſquadron; by which means Claudius was forced to retire to Rhegium, and this he accompliſhed with great difficulty. Hanno reſtored all the veſſels he had taken; but ordered the deputies ſent with them, to expoſtulate with the Roman general upon the infraction of the treáties ſubſiſting between the two republics. This expoſtulation, however juſt, produced an open rupture; Claudius ſoon after poſſeſſing himſelf of Meſſina.

55 Hanno intercepts the Roman fleet.

56 Carthaginians and Syracuſians defeated by the Romans.

Such was the beginning of the firſt Punic war, which is ſaid to have laſted 24 years. The firſt year, the Carthaginians and Syracuſians laid ſiege to Meſſina; but, not acting in concert as they ought to have done, were overthrown by the conſul Appius Claudius; and this defeat ſo much diſguſted Hiero with the Carthaginians, that he ſoon after concluded an alliance with the Romans. After this treaty, having no enemy to contend with but the Carthaginians, the Romans made themſelves maſters of all the cities on the weſtern coaſt of Sicily, and at the end of the campaign carried back moſt of their troops with them to take up their winter-quarters in Italy.

57 Agrigentum taken by the Romans.

The ſecond year, Hanno, the Carthaginian general, fixed his principal magazine at Agrigentum. This place was very ſtrong by nature, had been rendered almoſt impregnable by the new fortifications raiſed by the Carthaginians during the preceding winter, and was defended by a numerous garriſon commanded by one Hannibal, a general of great experience in war. For five months the Romans attempted to reduce the place by famine, and had actually brought the inhabitants to great diſtreſs, when a Carthaginian army of 50,000 foot, 6000 horſe, and 60 elephants, landed at Lilybæum, and from thence marched to Heraclea, within 20 miles of Agrigentum. There the general received a deputation from ſome of the inhabitants of Erbeſſa, where the Romans had their magazines, offering to put the town into his hands. It was accordingly delivered up; and by this means the Romans became ſo much diſtreſſed, that they had certainly been obliged to abandon their enterpriſe, had not Hiero ſupplied then with proviſions. But all the aſſiſtance he was able to give could not long have ſupported

Carthage.

them, as their army was so much weakened by disorders occasioned by famine, that, out of 100,000 men of whom it originally consisted, scarce a fourth part remained fit for service, and could no longer subsist on such parsimonious supplies. But in the mean time Hannibal acquainted Hanno that the city was reduced to the utmost distress; upon which he resolved to venture an engagement, which he had before declined. In this the Romans were victorious, and the city surrendered at discretion, though Hannibal, with the greatest part of the garrison made their escape. This ended the campaign; and the Carthaginians being greatly chagrined at their bad success, fined Hanno of an immense sum of money, and deprived him of his command, appointing Hamilcar to succeed him in the command of the land army, and Hannibal in that of the fleet.

The third year, Hannibal received orders to ravage the coasts of Italy; but the Romans had taken care to post detachments in such places as were most proper to prevent his landing, so that the Carthaginian found it impossible to execute his orders. At the same time the Romans perceiving the advantages of being masters of the sea, set about building 120 galleys.—While this was doing they made themselves masters of most of the inland cities, but the Carthaginians reduced or kept steady in their interest most of the maritime ones; so that both parties were equally successful during this campaign.

58 They build a fleet,

The fourth year, Hannibal by a stratagem made himself master of 17 Roman galleys; after which he committed great ravages on the coast of Italy, whither he had advanced to take a view of the Roman fleet. But he was afterwards attacked in his turn, lost the greatest part of his ships, and with great difficulty made his own escape. Soon after he was totally defeated by the consul Duillius, with the loss of 80 ships taken, thirteen sunk, 7000 men killed, and as many taken prisoners. After this victory Duillius landed in Sicily, put himself at the head of the land forces, relieved Segesta besieged by Hamilcar, and made himself master of Macella, though defended by a numerous garrison.

59 And defeat the Carthaginians at sea.

The fifth year, a difference arose between the Romans and their Sicilian allies, which came to such an height, that they encamped separately. Of this Hamilcar availed himself, and attacking the Sicilians in their entrenchments, put 4000 of them to the sword. He then drove the Romans from their posts, took several cities from them, and over-ran the greatest part of the country. In the mean time, Hannibal, after his defeat, sailed with the shattered remains of his fleet to Carthage; but in order to secure himself from punishment, he sent one of his friends with all speed, before the event of the battle was known there, to acquaint the senate, that the Romans had put to sea with a good number of heavy ill-built vessels, each of them carrying some machine, the use of which the Carthaginians did not understand; and asked, whether it was the opinion of the senate that Hannibal should attack them. These machines were the *corvi*, which were then newly invented, and by means of which, chiefly, Duillius had gained the victory. The senate were unanimous in their opinion, that the Romans should be attacked; upon which the messenger acquainted them with the unfortunate event of the battle. As the senators had already declared themselves for the engagement, they spared their general's life, and, according to Polybius even continued him in the command of the fleet. In a short time, being reinforced by a good number of galleys, and attended by some officers of great merit, he sailed for the coast of Sardinia. He had not been long here, before he was surprised by the Romans, who carried off many of his ships, and took great numbers of his men prisoners. This so incensed the rest, that they seized their unfortunate admiral, and crucified him; but who was his immediate successor does not appear.

60 Sicilians defeated by the Carthaginians.

The sixth year, the Romans made themselves masters of the islands of Corsica and Sardinia. Hanno, who commanded the Carthaginian forces in the latter, defended himself at a city called Olbia with incredible bravery; but being at last killed in one of the attacks, the place was surrendered, and the Romans soon became masters of the whole island.

61 Corsica and Sardinia reduced by the Romans.

The seventh year, the Romans took the town of Mytestratum, in Sicily, from whence they marched towards Camarina, but in their way were surrounded in a deep valley, and in the most imminent danger of being cut off by the Carthaginian army. In this extremity, a legionary tribune, by name *M. Calpurnius Flamma*, desired the general to give him 300 chosen men; promising, with this small company, to find the enemy such employment as should oblige them to leave a passage open for the Roman army. He performed his promise with a bravery truly heroic; for, having seized, in spite of all opposition, an eminence, and entrenched himself on it, the Carthaginians, jealous of his design, flocked from all quarters to drive him from his post. But the brave tribune kept their whole army in play, till the consul taking advantage of the diversion, drew his army out of the bad situation in which he had imprudently brought it.—The legions were no sooner out of danger, than they hastened to the relief of their brave companions: but all they could do was to save their bodies from the insults of their enemies; for they found them all dead on the spot, except Calpurnius, who lay under an heap of dead bodies, all covered with wounds, but still breathing. His wounds were immediately dressed, and it fortunately happened that none of them proved mortal; and for this glorious enterprise he received a crown of *gramen*. After this the Romans reduced several cities, and drove the enemy quite out of the territory of the Agrigentines; but were repulsed with great loss before Lipara.

62 The Roman army in great danger.

63 Rescued by the bravery of a legionary tribune.

The eighth year, Regulus, who commanded the Roman fleet, observing that of the Carthaginians lying along the coast in disorder, sailed with a squadron of ten galleys to observe their number and strength, ordering the rest of the fleet to follow him with all expedition. But as he drew too near the enemy, he was surrounded by a great number of Carthaginian galleys. The Romans fought with their usual bravery; but being overpowered with numbers, were obliged to yield. The consul, however, found means to make his escape, and join the rest of the fleet; and then had his full revenge of the enemy, 18 of their ships being taken, and 8 sunk.

64 Carthaginians defeated at sea by the Romans.

The ninth year, the Romans made preparations for invading

Carthage. invading Africa. Their fleet for this purpose consisted of 330 galleys, each of them having on board 120 soldiers and 300 rowers The Carthaginian fleet consisted of 360 sail, and was much better manned than that of the Romans. The two fleets met near Ecnomus, a promontory in Sicily; where, after a bloody engagement which lasted the greater part of the day, the Carthaginians were entirely defeated, with the loss of 30 galleys sunk, and 63 taken with all their men. The Romans lost only 24 galleys, which were all sunk.—After this victory, the Romans having refitted their fleet, set sail for the coast of Africa with all expedition. The first land they got sight of was Cape Hermea, where the fleet lay at anchor for some time waiting till the galleys and transports came up. From thence they coasted along till they arrived before Clupea, a city to the east of Carthage, where they made their first descent.

65 Regulus invades Africa.

66 Carthaginians in great consternation.

No words can express the consternation of the Carthaginians, on the arrival of the Romans in Africa. The inhabitants of Clupea were so terrified, that, according to Zonaras, they abandoned the place, which the Romans immediately took possession of. Having left there a strong garrison to secure their shipping, and keep the adjacent territory in awe, they moved nearer Carthage, taking a great number of towns: they likewise plundered a prodigious number of villages, laid vast numbers of noblemens seats in ashes, and took above 20,000 prisoners. In short, having plundered and ravaged the whole country, almost to the gates of Carthage, they returned to Clupea loaden with the immense booty they had acquired in the expedition.

67 Success of Regulus.

The tenth year, Regulus pushed on his conquests with great rapidity. To oppose his progress, Hamilcar was recalled from Sicily, and with him Bostar and Asdrubal were joined in command. Hamilcar commanded an army just equal to that of Regulus. The other two commanded separate bodies, which were to join him, or act apart as occasion required. But, before they were in a condition to take the field, Regulus, pursuing his conquests, arrived on the banks of the *Bragada*, a river which empties itself into the sea at a small distance from Carthage. Here he had a monstrous serpent to contend with, which, according to the accounts of those days, infected the waters of the river, poisoned the air, and killed all other animals with its breath alone. When the Romans went to draw water, this huge dragon attacked them; and, twisting itself round their bodies, either squeezed them to death or swallowed them alive. As its hard and thick scales were proof against their darts and arrows, they were forced to have recourse to the balistæ, which they made use of in the sieges to throw great stones, and to beat down the walls of besieged cities. With these they discharged showers of huge stones against this new enemy, and had the good luck, with one of them, to break his back-bone; which disabled him from twisting and winding his immense body, and by that means gave the Romans an opportunity of approaching and dispatching him with their darts. But his dead body corrupted the air and the water of the river; and spread so great an infection over the whole country, that the Romans were obliged to decamp. We are told that Regulus sent to Rome the skin of this monster, which was 120 feet long; and that it was hung up in a temple, where it was preserved to the time of the Numantine war.

68 He kills a monstrous serpent.

69 Defeats the Carthaginians;

Having passed the river, he besieged *Adis*, or *Adda*, not far from Carthage, which the enemy attempted to relieve; but as they lay encamped among hills and rocks, where their elephants, in which the main strength of their army consisted, could be of no use, Regulus attacked them in their camp, killed 17,000 of them, and took 5000 prisoners, and 18 elephants. Upon the fame of this victory, deputations came from all quarters, insomuch that the conqueror in a few days became master of 80 towns; among which were the city and port of Utica. This increased the alarm at Carthage; which was reduced to despair, when Regulus laid siege to Tunis, a great city about nine miles from the capital. The place was taken in sight of the Carthaginians, who, from their walls, beheld all the operations of the siege, without making the least attempt to relieve it. And to complete their misfortunes, the Numidians, their neighbours, and implacable enemies, entered their territories, committing every where the most dreadful devastations, which soon occasioned a great scarcity of provisions in the city. The public magazines were soon exhausted: and, as the city was full of selfish merchants, who took advantage of the public distress, to sell provisions at an exhorbitant price, a famine ensued, with all the evils which attended it.

70 And reduces them to the utmost despair.

71 His proposals of peace rejected.

In this extremity Regulus advanced to the very gates of Carthage; and having encamped under the walls, sent deputies to treat of a peace with the senate. The deputies were received with inexpressible joy; but the conditions they proposed were such that the senate could not hear them without the greatest indignation. They were, 1. That the Carthaginians should relinquish all claims to Sardinia, Corsica, and Sicily. 2. That they should restore to the Romans all the prisoners they had taken from them since the beginning of the war. 3. That if they cared to redeem any of their own prisoners, they should pay so much a-head for them as Rome should judge reasonable. 4. That they should for ever pay the Romans an annual tribute. 5. That for the future they should fit out but one man of war for their own use, and 50 triremes to serve in the Roman fleet, at the expence of Carthage, when required by any of the future consuls. These extravagant demands provoked the senators, who loudly and unanimously rejected them; the Roman deputies, however, told them that Regulus would not alter a single letter of the proposals, and that they must either conquer the Romans or obey them.

72 Xanthippus appointed to command the Carthaginian army;

In this extreme distress, some mercenaries arrived from Greece, among whom was a Lacedemonian, by name Xanthippus, a man of great valour and experience in war. This man, having informed himself of the circumstances of the late battle, declared publicly, that their overthrow was more owing to their own misconduct than to the superiority of the enemy. This discourse being spread abroad, came at last to the knowledge of the senate; and by them, and even by the desire of the Carthaginian generals themselves, Xanthippus was appointed commander in chief of their forces. His first care was to discipline his troops in a

proper

Carthage. proper manner. He taught them how to march, encamp, widen and close the ranks, and rally after the Lacedemonian manner under their proper colours. He then took the field with 12,000 foot, 4000 horse, and 100 elephants. The Romans were surprised at the sudden alteration they observed in the enemy's conduct; but Regulus, elated with his last success, came and encamped at a small distance from the Carthaginian army in a vast plain, where their elephants and horse had room to act. The two armies were parted by a river, which Regulus boldly passed, by which means he left no room for a retreat in case of any misfortune. The engagement began with great fury; but ended in the total defeat of the Romans, who except 2000 that escaped to Clupea, were all killed or taken prisoners, and among the latter was Regulus himself. The loss of the Carthaginians scarce exceeded 800 men.

73 The Romans utterly defeated, and Regulus taken.

The Carthagenians remained on the field of battle till they had stripped the slain; and then entered their metropolis, which was almost the only place left them, in great triumph. They treated all their prisoners with great humanity, except Regulus; but as for him, he had so insulted them in his prosperity, that they could not forbear shewing the highest marks of their resentment. According to Zonaras and others, he was thrown into a dungeon, where he had only sustenance allowed him barely sufficient to keep him alive. Nay, his cruel masters, to heighten his other torments, ordered an huge elephant (at the sight of which animal, it seems, he was greatly terrified) to be constantly placed near him; which prevented him from enjoying any tranquillity or repose.

74 He is cruelly used.

The eleventh year of this war, the Carthaginians, elated with their victory over Regulus, began to talk in a very high strain, threatening Italy itself with an invasion. To prevent this, the Romans took care to garrison all their maritime towns, and fitted out a new fleet. In the mean time, the Carthaginians besieged Clupea and Utica in vain, being obliged to abandon their enterprize, upon hearing that the Romans were equipping a fleet of 350 sail. The Carthaginians having with incredible expedition refitted their old vessels, and built a good number of new ones, met the Roman fleet off Cape Hermea. An engagement ensued which the Carthaginians were utterly defeated; 104 of their ships being sunk, 30 taken, and 15,000 of their soldiers and rowers killed in the action. The Romans pursued their course to Clupea, where they were no sooner landed, than they found themselves attacked by the Carthaginian army, under the two Hanno's, father and son. But, as the brave Xanthippus no longer commanded their army, notwithstanding the Lacedemonian discipline he had introduced among them, they were routed at the very first onset, with the loss of 9000 men, and among them many of their chief lords.

75. Carthaginians defeated by sea and land.

Notwithstanding all their victories, however, the Romans found themselves now obliged, for want of provisions, to evacuate both Clupea and Utica, and abandon Africa altogether. Being desirous of signalizing the end of their consulate by some important conquest on Sicily, the consuls steered for that island, contrary to the advice of their pilots, who represented their danger, on account of the season being so far advanced. Their obstinacy proved the destruction of the whole fleet; for a violent storm arising, out of 370 vessels, only 80 escaped shipwreck, the rest being swallowed up in the sea, or dashed against the rocks. This was by far the greatest loss that Rome had ever sustained; for besides the ships that were cast away with their crews, a numerous army was destroyed, with all the riches of Africa, which had been by Regulus amassed and deposited in Clupea, and were now from thence transporting to Rome. The whole coast from Pachinum to Camerina was covered with dead bodies and wrecks of ships; so that history can scarce afford an example of such a dreadful disaster.

76 Romans obliged to abandon Africa.

77 Their fleet totally destroyed by a storm.

The twelfth year the Carthaginians hearing of this misfortune of the Romans, renewed the war in Sicily with fresh fury, hoping the whole island, which was now left defenceless, would fall into their hands. Carthalo, a Carthaginian commander besieged and took Agrigentum. The town he laid in ashes and demolished the walls, obliging the inhabitants to fly to Olympium. Upon the news of this success, Asdrubal was sent to Sicily with a large reinforcement of troops, and 150 elephants. They likewise fitted out a squadron with which they retook the island of Cosyra, and marched a strong body of forces into Mauritania and Numidia, to punish the people of those countries for shewing a disposition to join the Romans. In Sicily the Romans possessed themselves of Cephalodium and Panormus, but were obliged by Carthalo to raise the siege of Drepanum with great loss.

78 Agrigentum taken and destroyed by the Carthaginians.

The 13th year the Romans sent out a fleet of 260 galleys, which appeared off Lilybæum in Sicily; but finding this place too strong, they steered from thence to the eastern coast of Africa, where they made several descents, surprised some cities, and plundered several towns and villages. They arrived safe at Panormus, and in a few days set sail for Italy, having a fair wind till they came off Cape Palinurus, where so violent a storm overtook them, that 160 of their galleys and a great number of their transports were lost; upon which the Roman senate made a decree, that, for the future, no more than 50 vessels should be equipped; and that these should be employed only in guarding the coast of Italy and transporting the troops into Sicily.

79 The Romans fit out a new fleet.

80 Which is again destoyed.

The 14th year, the Romans made themselves masters of Himera and Lipara in Sicily; and the Carthaginians conceiving new hopes of conquering that island, began to make fresh levies in Gaul and Spain, and to equip a new fleet. But their treasures being exhausted, they applied to Ptolemy king of Egypt, intreating him to lend them 2000 talents: but he being resolved to stand neuter, refused to comply with their request; telling them, that he could not without breach of fidelity assist one friend against another. However, the republic of Carthage making an effort, equipped a fleet of 100 sail, and raised an army of 30,000 men, horse and foot, and 240 elephants, appointing Asdrubal commander in chief both of the fleet and army. The Romans then finding the great advantages of a fleet, resolved to equip one notwithstanding all former disasters; and while the vessels were building, two consuls were chosen, men of valour and experience, to supersede the acting ones in Sicily. Metellus, however, one of the former consuls being continued with the title of proconsul, found means

81 They fit out another.

Carthage.

82 Carthaginians utterly defeated.

means to draw Asdrubal into a battle on disadvantageous terms near Panormus, and then sallying out upon him, gave him a most terrible overthrow. Twenty thousand of the enemy were killed, and many elephants. An hundred and four elephants were taken with their leaders, and sent to Rome, where they were hunted and put to death in the circus.

83 Lilybæum besieged by the Romans.

* See Lilybæum.

The 15th year, the Romans besieged Lilybæum; and the siege continued during the rest of the first Punic war, and was the only thing remarkable that happened during that time*. The Carthaginians, on the first news of its being besieged, sent Regulus with some deputies to Rome to treat of a peace: but instead of forwarding the negociation, he hindered it; and notwithstanding he knew the torments prepared for him at Carthage, could not be prevailed upon to stay at Rome, but returning to his enemies country, was put to a most cruel death. During this siege, the Roman fleet under Claudius Pulcher was utterly defeated by Adherbal the Carthaginian admiral. Ninety of the Roman galleys were lost in the action, 8000 of their men either killed or drowned, and 20,000 taken and sent prisoners to Carthage; and the Carthaginians gained this signal victory without the loss of a single ship, or even a single man. Another Roman fleet met with a still severer fate. It consisted of 120 galleys, 800 transports, and was laden with all sorts of military stores and provisions. Every one of these vessels were lost by a storm, with all they contained, not a single plank being saved that could be used again; so that the Romans found themselves once more deprived of their whole naval force.

84 They are defeated at sea by the Carthaginians.

85 A Roman fleet utterly destroyed by a storm.

86 Hamiclar Barcas sent into Sicily.

In the mean time, the Carthaginian soldiery having shown a disposition to mutiny, the senate sent over Hamilcar Barcas, father of the famous Hannibal, to Sicily. He received a charte blanche from the senate to act as he thought proper; and by his excellent conduct and resolution, showed himself the greatest general of his age. He defended Eryx, which he had taken by surprise, with such vigour, that the Romans would never have been able to make themselves masters of it, had they not fitted out a new fleet at the expence of private citizens, which, having utterly defeated that of the Carthaginians, Hamilcar, notwithstanding all his valour, was obliged to yield up the place which he had so long and so bravely defended. The following articles of peace were immediately drawn up between the two commanders. 1. The Carthaginians shall evacuate all the places which they have in Sicily, and entirely quit that island. 2. They shall, in 20 years, pay the Romans, at equal payments every year, 2200 talents of silver, that is, L. 437,250 Sterling. 3. They shall restore the Roman captives and deserters without ransom, and redeem their own prisoners with money. 4. They shall not make war upon Hiero king of Syracuse, or his allies. These articles being agreed to, Hamilcar surrendered Eryx upon condition that all his soldiers should march out with him upon his paying for each of them 18 *Roman denarii*. Hostages were given on both sides, and deputies were sent to Rome to procure a ratification of the treaty by the senate. After the senators had thoroughly informed themselves of the state of affairs, two more articles were added, *viz.* 1. That 1000 talents should be paid immediately, and the 2200 in the space of 10 years at equal payments. 2. That the Carthaginians should quit all the little islands about Italy and Sicily, and never more come near them with ships of war, or raise mercenaries in those places. Necessity obliged Hamilcar to consent to these terms; but he returned to Carthage with an hatred to the Romans, which he did not even suffer to die with him, but transmitted to his son the great Hannibal.

87 Peace with the Romans.

88 Causes of the war with the mercenaries.

The Carthaginians were no sooner got out of this bloody and expensive war, than they found themselves engaged in another which was like to have proved fatal to them. It is called by ancient historians the *Libyan war*, or the *war with the mercenaries*. The principal occasion of it was, that when Hamilcar returned to Carthage, he found the republic so much impoverished, that, far from being able to give these troops the largesses and rewards promised them, it could not pay them their arrears. He had committed the care of transporting them to one *Cisco*, who, being an officer of great penetration, as though he had foreseen what would happen, did not ship them off all at once, but in small and separate parties, that those who came first might be paid off and sent home before the arrival of the rest. The Carthaginians at home, however, did not act with the same prudence. As the state was almost entirely exhausted by the last war, and the immense sum of money, in consequence of the peace, paid to the Romans, they judged it would be a laudable action to save something to the public. They did not therefore pay off the mercenaries in proportion as they arrived, thinking it more proper to wait till they all came together, with a view of obtaining some remission of their arrears. But being soon made sensible of their wrong conduct on this occasion, by the frequent disorders these barbarians committed in the city, they with some difficulty prevailed upon the officers to take up their quarters at Sicca, and canton their troops in that neighbourhood. To induce them to this, however, they gave them a sum of money for their present subsistence, and promised to comply with their pretensions when the remainder of their troops arrived from Sicily. Here, being wholly immersed in idleness, to which they had long been strangers, a neglect of discipline ensued, and of course a petulant and licentious spirit immediately took place. They were now determined not to acquiesce in receiving their bare pay, but to insist upon the rewards Hamiclar had promised them, and even to compel the state of Carthage to comply with their demands by force of arms. The senate being informed of the mutinous disposition of the soldiery, dispatched Hanno, one of the suffetes, to pacify them. Upon his arrival at Sicca, he expatiated largely upon the poverty of the state, and the heavy taxes with which the citizens of Carthage were loaded; and therefore, instead of answering their high expectations, he desired them to be satisfied with receiving part of their pay, and remit the remainder to serve the pressing exigencies of the republic. The mercenaries being highly provoked, that neither Hamilcar, nor any other of the principal officers who commanded them in Sicily, and were the best judges of their merit, made their appearance on this occasion, but only Hanno, a person utterly unknown, and above all others

89 Imprudent conduct of Hanno.

Carthage. others utterly disagreeable to them, immediately had recourse to arms. Assembling therefore in a body to the number of 20,000, they advanced to Tunis, and immediately encamped before that city.

The Carthaginians being greatly alarmed at the approach of so formidable a body to Tunis, made large concessions to the mercenaries, in order to bring them back to their duty: but, far from being softened, they grew more insolent upon these concessions, taking them for the effects of fear; and therefore were altogether averse to thoughts of accommodation. The Carthaginians, making a virtue of a necessity, showed a disposition to satisfy them in all points, and agreed to refer themselves to the opinion of some general in Sicily, which they had all along desired; leaving the choice of such commander entirely to them. Gisco was accordingly pitched upon to mediate this affair, the mercenaries believing Hamilcar to have been a principal cause of the ill treatment they met with, since he never appeared among them, and, according to the general opinion, had voluntarily resigned his commission. Gisco soon arrived at Tunis with money to pay the troops; and after conferring with the officers of the several nations apart, he harangued them in such a manner, that a treaty was upon the point of being concluded, when Spendius and Mathos, two of the principal mutineers, occasioned a tumult in every part of the camp. Spendius was by nation a Campanian, who had been a slave at Rome, and had fled to the Carthaginians. The apprehensions he was under of being delivered to his old master, by whom he was sure to be hanged or crucified, prompted him to break off the accommodation. Mathos was an African, and free born; but as he had been active in raising the rebellion, and was well acquainted with the implacable disposition of the Carthaginians, he knew that a peace must infallibly prove his ruin. He therefore joined with Spendius, and insinuated to the Africans the danger of concluding a treaty at that juncture, which could not but leave them singly exposed to the rage of the Carthaginians. This so incensed the Africans, who were much more numerous than the troops of any other nation, that they immediately assembled in a tumultuous manner. The foreigners soon joined them, being inspired by Spendius with an equal degree of fury. Nothing was now to be heard but the most horrid oaths and imprecations against Gisco and the Carthaginians. Whoever offered to make any remonstrance, or lend an ear to temperate counsels, was stoned to death by the enraged multitude. Nay, many persons lost their lives barely for attempting to speak, before it could be known whether they were in the interest of Spendius or the Carthaginians.

In the midst of these commotions, Gisco behaved with great firmness and intrepidity. He left no methods untried to soften the officers and calm the minds of the soldiery; but the torrent of sedition was now so strong, that there was no possibility of keeping it within bounds. They therefore seized upon the military chest, dividing the money among themselves in part of their arrears, put the person of Gisco under an arrest, and treated him, as well as his attendants, with the utmost indignity. Mathos and Spendius, to destroy the remotest hopes of an accommodation with Carthage, applauded the courage and resolution of their men, loaded the unhappy Gisco and his followers with irons, and formally declared war against the Carthaginians. All the cities of Africa to whom they had sent deputies to exhort them to recover their liberty, soon came over to them, except Utica and Hippo Diarrhytus. By this means their army being greatly increased, they divided it into two parts, with one of which they moved towards Utica, whilst the other marched to Hippo, in order to besiege both places. The Carthaginians, in the mean time, found themselves ready to sink under the pressure of their misfortunes. After they had been harassed 24 years by a most cruel and destructive foreign war, they entertained some hopes of enjoying repose. The citizens of Carthage drew their particular subsistence from the rents or revenues of their lands, and the public expences from the tribute paid from Africa; all which they were not only deprived of at once, but, what was worse, had it directly turned against them. They were destitute of arms and forces either by sea or land; had made no preparations for the sustaining of a siege, or the equipping of a fleet. They suffered all the calamities incident to the most ruinous civil war; and, to complete their misery, had not the least prospect of receiving assistance from any foreign friend or ally. Notwithstanding their deplorable situation, however, they did not despond, but pursued all the measures necessary to put themselves into a posture of defence. Hanno was appointed commander in chief of all their forces; and the most strenuous efforts were made, not only to repel all the attempts of the mutineers, but even to reduce them by force of arms.

Carthage.

90 The mercenaries declare war.

In the mean time Mathos and Spendius laid siege to Utica and Hippacra at once; but as they were carried on by detachments drawn from the army for that purpose, they remained with the main body of their forces at Tunis, and thereby cut off all communication betwixt Carthage and the continent of Africa. By this means the capital was kept in a kind of blockade. The Africans likewise harassed them by perpetual alarms, advancing to the very walls of Carthage by day as well as by night, and treating with the utmost cruelty every Carthaginian that fell into their hands.

91 They are defeated by Hanno.

Hanno was dispatched to the relief of Utica with a good body of forces, 100 elephants, and a large train of battering engines. Having taken a view of the enemy, he immediately attacked their intrenchments, and, after an obstinate dispute, forced them. The mercenaries lost a vast number of men; and consequently the advantages gained by Hanno were so great, that they might have proved decisive, had he made a proper use of them: But becoming secure after his victory, and his troops being every where off their duty, the mercenaries, having rallied their forces, fell upon him, cut off many of his men, forced the rest to fly into the town, retook and plundered the camp, and seized all the provisions, military stores, &c. brought to the relief of the besieged. Nor was this the only instance of Hanno's military incapacity. Notwithstanding he lay encamped in the most advantageous manner near a town called *Corza*, at which place he twice overthrew the enemy, and had it in his power

92 He is in his turn defeated.

Carthage. power to have totally ruined them, he yet neglected to improve those advantages, and even suffered the mercenaries to possess themselves of the isthmus, which joined the peninsula on which Carthage stood, to the continent of Africa.

93 Hamilcar Barcas appointed to command against them.

These repeated mistakes induced the Carthaginians once more to place Hamilcar Barcas at the head of their forces. He marched against the enemy with 10,000 men, horse and foot; being all the troops the Carthaginians could then assemble for their defence; a full proof of the low state to which they were at that time reduced. As Mathos, after he had possessed himself of the isthmus, had posted proper detachments in two passes on two hills facing the continent, and guarded the bridge over the Bagrada, which through Hanno's neglect he had taken, Hamilcar saw little probability of engaging him upon equal terms, or indeed of coming at him. Observing, however, that on the blowing of certain winds the mouth of the river was choaked up with sand, so as to become passable, though with no small difficulty, as long as these winds continued; he halted for some time at the river's mouth, without communicating his design to any person. As soon as the wind favoured his intended project, he passed the river privately by night, and immediately after his passage he drew up the troops in order of battle, and advancing into the plain where his elephants were capable of acting, moved towards Mathos, who was posted at the village near the bridge. This daring action greatly surprised and intimidated the Africans. However, Spendius receiving intelligence of the enemy's motions, drew a body of 10,000 men out of Mathos's camp, with which he attended Hamilcar on one side, and ordered 15,000 from Utica to observe him on the other, thinking by this means to surround the Carthaginians, and cut them all off at one stroke. By feigning a retreat, Hamilcar found means to engage them at a disadvantage; and gave them a total overthrow, with the loss of 6000 killed and 2000 taken prisoners. The rest fled, some to the town at the bridge, and others to the camp at Utica. He did not give them time to recover from their defeat, but pursued them to the town near the bridge before mentioned; which he entered without opposition, the mercenaries flying in great confusion to Tunis; and upon this many towns submitted of their own accord to the Carthaginians, whilst others were reduced by force.

94 He defeats them.

Notwithstanding these disasters, Mathos pushed on the siege of Hippo with great vigour, and appointed Spendius and Autaritus, commanders of the Gauls, with a strong body, to observe the motions of Hamilcar. These two commanders, therefore, at the head of a choice detachment of 6000 men drawn out of the camp at Tunis, and 2000 Gallic horse, attended the Carthaginian general, approaching him as near as they could with safety, and keeping close to the skirts of the mountains. At last Spendius, having received a strong reinforcement of Africans and Numidians, and possessing himself of all the heights surrounding the plain in which Hamilcar lay encamped, resolved not to let slip so favourable an opportunity of attacking him. Had a battle now ensued, Hamilcar and his army must in all probability have been cut off; but by the desertion of one Naravasus, a young Numidian nobleman, with 2000 men, he found himself enabled to offer his enemies battle. The fight was obstinate and bloody; but at last the mercenaries were entirely overthrown, with the loss of 10,000 men killed and 4000 taken prisoners. All the prisoners that were willing to enlist in the Carthaginian service, Hamilcar received among his troops, supplying them with the arms of the soldiers who had fallen in the engagement. To the rest he gave full liberty to go where they pleased; upon condition that they should never for the future bear arms against the Carthaginians; informing them at the same time, however, that as many violators of this agreement as fell into his hands must expect to find no mercy.

Carthage. 95 Mercenaries again defeated.

96 They put to death all the Carthaginian prisoners.

Mathos and his associates, fearing that this affected lenity of Hamilcar might occasion a defection among the troops, thought that the best expedient would be to put them upon some action so execrable in its nature that no hopes of reconciliation might remain. By their advice, therefore, Gisco and all the Carthaginian prisoners were put to death; and when Hamilcar sent to demand the remains of his countrymen, he received for answer, that whoever presumed hereafter to come upon that errand, should meet with Gisco's fate: after which they came to a resolution to treat with the same barbarity all such Carthaginians as should fall into their hands. In return for this enormity; Hamilcar threw all the prisoners that fell into his hands to be devoured by wild beasts; being convinced that compassion served only to make his enemies more fierce and untractable.

The war was now carried on generally to the advantage of the Carthaginians; nevertheless, the malecontents still found themselves in a capacity to take the field with an army of 50,000 men. They watched Hamilcar's motions; but kept on the hills, carefully avoiding to come down into the plains, on account of the Numidian horse and Carthaginian elephants. Hamilcar, being much superior in skill to any of their generals, at last shut them up in a post so situated that it was impossible to get out of it. Here he kept them strictly besieged, and the mercenaries, not daring to venture a battle, began to fortify their camp and surround it with ditches and intrenchments. They were soon pressed by famine so sorely, that they were obliged to eat one another; but they were driven desperate by the consciousness of their guilt, and therefore did not desire any terms of accommodation. At last being reduced to the utmost extremity of misery, they insisted that Spendius, Autaritus, and Zarxas, their leaders, should in person have a conference with Hamilcar, and make proposals to him. Peace was accordingly concluded upon the following terms, *viz.* That ten of the ringleaders of the malecontents should be left entirely to the mercy of the Carthaginians; and that the troops should all be disarmed, every man retiring only in a single coat. The treaty was no sooner concluded, than Hamilcar, by virtue of the first article, seized upon the negociators themselves, and the army being informed that their chiefs were under arrest, had immediately recourse to arms, as suspecting they were betrayed; but Hamilcar, drawing out his army in order of battle, surrounded them, and either cut them to pieces,

97 They are besieged by Hamilcar.

98 40,000 of them destroyed.

pieces, or trod them to death with his elephants. The number of wretches who perished on this occasion amounted to above 40,000.

After the destruction of this army, Hamilcar invested Tunis, whither Mathos had retired with all his remaining forces. Hamilcar had another general, named *Hannibal*, joined in the command with him, Hannibal's quarter was on the road leading to Carthage, and Hamilcar's on the opposite side. The army was no sooner encamped, than Hamilcar caused Spendius, and the rest of the prisoners, to be led out in the view of the besieged, and crucified near the walls. Mathos, however, observing that Hannibal did not keep so good a guard as he ought to have done, made a sally, attacked his quarters, killed many of his

99 Hannibal taken and crucified by Mathos.

men, took several prisoners, among whom was Hannibal himself, and plundered his camp. Taking the body of Spendius from the cross, Mathos immediately substituted Hannibal, in its room; and 30 Carthaginian prisoners of distinction were crucified around him. Upon this disaster, Hamilcar immediately decamped, and posted himself along the sea-coast, near the mouth of the river Bagrada.

The senate, though greatly terrified by this unexpected blow, omitted no means necessary for their preservation. They sent 30 senators, with Hanno at their head, to consult with Hamilcar about the proper measures for putting an end to this unnatural war, conjuring, in the most pressing manner, Hanno to be reconciled to Hamilcar, and to sacrifice his private resentment to the public benefit. This, with some difficulty, was effected: and the two generals came to full resolution to act in concert for the good of the public. The senate at the same time, ordered all the youth capable of bearing arms to be pressed into the service: by which means a strong rein-

100 Mathos entirely defeated and taken prisoner.

forcement being sent to Hamilcar, he soon found himself in a condition to act offensively. He now defeated the enemy in all rencounters, drew Mathos into frequent ambuscades, and gave him one notable overthrow near Leptis. This reduced the rebels to the necessity of hazarding a decisive battle, which proved fatal to them. The mercenaries fled almost at the first onset; and most of their army fell in the field of battle, and in the pursuit. Mathos, with a few, escaped to a neighbouring town, where he was taken alive, carried to Carthage and executed; and then, by the reduction of the revolted cities, an end was put to this war, which from the excesses of cruelty committed in it, according to Polybius, went among the Greeks by the name of the *inexpiable war*.

During the Lybian war, the Romans upon some absurd pretences, wrested the island of Sardinia from the Carthaginians; which the latter not being able to

101 Hamilcar's scheme to equal Carthage with Rome.

resist, were obliged to submit to. Hamilcar finding his country not in a condition to enter into an immediate war with Rome, formed a scheme to put it on a level with that haughty republic. This was by making an entire conquest of Spain, by which means the Carthaginians might have troops capable of coping with the Romans. In order to facilitate the execution of this scheme, he inspired both his son-in-law Asdrubal, and his son Hannibal, with an implacable aversion to the Romans, as the great opposers of his country's grandeur. Having completed all the necessary preparations, Hamilcar, after having greatly enlarged the Carthaginian dominions in Africa, entered Spain, where he commanded nine years, during which time he subdued many warlike nations, and amassed an immense quantity of treasure, which he distributed partly amongst his troops, and partly amongst the great men at Carthage; by which means he supported his interests with these two powerful bodies. At last, he was

102 His death.

killed in a battle, and was succeeded by his son-in-law Asdrubal. This general fully answered the expectations of his countrymen; greatly enlarged their dominions in Spain; and built the city of New Carthage, now Carthagena. He made such progress in his conquests, that the Romans began to grow jealous. They did not, however, choose at present to come to an open rupture, on account of the apprehensions they were under of an invasion from the Gauls. They judged it most proper, therefore, to have recourse to milder methods; and prevailed upon Asdrubal to conclude a new treaty with them. The articles of it were,

103 Asdrubal's treaty with the Romans.

1. That the Carthaginians should not pass the Iberus. 2. That the Saguntines, a colony of Zacynthians, and a city situated between the Iberus and that part of Spain subject to the Carthaginians, as well as the other Greek colonies there, should enjoy their ancient rights and privileges.

104 He is murdered.

Asdrubal, after having governed the Carthaginian dominions in Spain for eight years, was treacherously murdered by a Gaul whose master he had put to death. Three years before this happened, he had written to Carthage, to desire that young Hannibal, then twenty-two years of age, might be sent to him. This request was complied with, notwithstanding the opposition of Hanno; and from the first arrival of the young man in the camp, he became the darling of the whole army. The great resemblance he bore to Hamilcar, rendered him extremely agreeably to the troops. Every talent and qualification he seemed to possess that can contribute towards forming a great man. After the death of Asdrubal, he was saluted general by the

105 Succeeded by Hannibal, who makes vast conquests in Spain.

army with the highest demonstrations of joy. He immediately put himself in motion: and, in the first campaign conquered the Olcades, a nation seated near the Iberus. The next year he subdued the Vaccæi, another nation in that neighbourhood. Soon after, the Carpætani, one of the most powerful nations in Spain, declared against the Carthaginians. Their army consisted of 100,000 men, with which they proposed to attack Hannibal on his return from the Vaccæi; but by a stratagem they were utterly defeated, and the whole nation obliged to submit.

Nothing now remained to oppose the the progress of the Carthaginian arms but the city of Saguntum. Hannabal, however, for some time, did not think proper to come to a rupture with the Romans by attacking that place. At last he found means to embroil some of the neighbouring cantons, especially the Tur-

106 He attacks Saguntum.

detani, or, as Appian calls them, the *Torboletæ*, with the Saguntines, and thus furnished himself with a pretence to attack their city. Upon the commencement of the siege, the Roman senate dispatched two ambassadors to Hannibal, with orders to proceed to Carthage in case the general refused to give them satisfaction. They were scarce landed when Hannibal, who was carrying on the siege of Saguntum with great vigour, Carthage. vigour, sent them word that he had something else to do than to give audience to ambassadors. At last, however, he admitted them; and, in answer to their remonstrances, told them, that the Saguntines had drawn their misfortunes upon themselves, by committing hostilities against the allies of Carthage; and at the same time desired the deputies, if they had any complaints to make of him, to carry them to the senate of Carthage. On their arrival in that capital, they demanded that Hannibal might be delivered up to the Romans to be punished according to his deserts; and this not being complied with, war was immediately declared between the two nations.

The Saguntines are said to have defended themselves for eight months with incredible bravery. At last, however, the city was taken, and the inhabitants were treated with the utmost cruelty. After this conquest, Hannibal put his African troops into winter-quarters at New Carthage; but in order to gain their affection, he permitted the Spaniards to retire to their respective homes.

107 And takes it.

The next campaign, having taken the necessary measures for securing Africa and Spain, he passed the Iberus, subdued all the nations betwixt that river and the Pyrenees, appointed Hanno commander of all the new conquered district, and immediately began his march for Italy. Upon mustering his forces, after they had been weakened by sieges, desertion, mortality, and a detachment of 10,000 foot and 1000 horse left with Hanno to support him in his new post, he found them to amount to 50,000 foot and 9000 horse, all veteran troops, and the best in the world. As they had left their heavy baggage with Hanno, and were all light armed, Hannibal easily crossed the Pyrenees; passed by Ruscino, a frontier town of the Gauls; and arrived on the banks of the Rhone without opposition. This river he passed, notwithstanding of some opposition from the Gauls; and was for some time in doubt whether he should advance to engage the Romans, who, under Scipio, were bending their march that way, or continue his march for Italy. But to the latter he was soon determined by the arrival of Magilus prince of the Boii, who brought rich presents with him, and offered to conduct the Carthaginian army over the Alps. Nothing could have happened more favourable to Hannibal's affairs than the arrival of this prince, since there was no room to doubt the sincerity of his intentions. For the Boii bore an implacable enmity to the Romans, and had even come to an open rupture with them upon the first news that Italy was threatened with an invasion from the Carthaginians.

108 He sets out for Italy.

It is not known with certainty where Hannibal began to ascend the Alps. As soon as he began his march, the petty kings of the country assembled their forces in great numbers: and taking possession of the eminences over which the Carthaginians must necessarily pass, they continued harassing them, and were no sooner driven from one eminence than they seized on another, disputing every foot of land with the enemy, and destroying great numbers of them by the advantage they had of the ground. Hannibal, however, having found means to possess himself of an advantageous post, defeated and dispersed the enemy; and soon after took their capital city, where he found the prisoners, horses, &c. that had before fallen into the hands of the enemy, and likewise corn sufficient to serve the army for three days. At last, after a most fatiguing march of nine days, he arrived at the top of the mountains. Here he encamped, and halted two days, to give his wearied troops some repose, and to wait for the stragglers. As the snow was lately fallen in great plenty, and covered the ground, this sight terrified the Africans and Spaniards, who were much affected with the cold. In order therefore to encourage them, the Carthaginian general led them to the top of the highest rock on the side of Italy, and thence gave them a view of the large and fruitful plains of Insubria, acquainting them that the Gauls, whose country they saw, were ready to join them. He also pointed out to them the place whereabout Rome stood, telling them, that by climbing the Alps, they had scaled the walls of that rich metropolis; and having thus animated his troops, he decamped, and began to descend the mountains. The difficulties they met with in their descent were much greater than those that had occurred while they ascended. They had indeed no enemy to contend with, except some scattered parties that came to steal rather than to fight; but the deep snows, the mountains of ice, craggy rocks, and frightful precipices, proved more terrible than any enemy. After they had for some days marched through narrow, steep, and slippery ways, they came at last to a place which neither elephants, horses, nor men, could pass. The way which lay between two precipices was exceeding narrow; and the declivity, which was very steep, had become more dangerous by the falling away of the earth. Here the guides stopped; and the whole army being terrified, Hannibal proposed at first to march round about, and attempt some other way: but all places round him being covered with snow, he found himself reduced to the necessity of cutting away into the rock itself, through which his men, horses, and elephants, might descend. This work was accomplished with incredible labour; and then Hannibal, having spent nine days in ascending, and six in descending, the Alps, gained at length Insubria; and, notwithstanding all the disasters he had met with by the way, entered the country with all the boldness of a conqueror.

109 He crosses the Alps.

Hannibal, on his entry into Insubria, reviewed his army, when he found that of the 50,000 foot with whom he set out from New Carthage five months and 15 days before, he had now but 20,000, and that his 9000 horse were reduced to 6000. His first care, after he entered Italy, was to refresh his troops; who after so long a march, and such inexpressible hardships, looked like as many skeletons raised from the dead, or savages born in a desert. He did not, however, suffer them to languish long in idleness; but, joining the Insubrians, who were at war with the Taurinians, laid siege to Taurinum, the only city in the country, and in three days time became master of it, putting all who resisted to the sword. This struck the neighbouring barbarians with such terror, that of their own accord they submitted to the conqueror, and supplied his army with all sorts of provisions.

110 Taurinum taken.

Scipio, the Roman general, in the mean time, who had gone in quest of Hannibal on the banks of the Rhone, was surprised to find his antagonist had crossed

Carthage.

111 The Romans defeated near the Ticinus.

sed the Alps and entered Italy. He therefore returned with the utmost expedition. An engagement ensued near the river Ticinus, in which the Romans were defeated. The immediate consequence was, that Scipio repassed that river, and Hannibal continued his march to the banks of the Po. Here he staid two days, before he could cross that river over a bridge of boats. He then sent Mago in pursuit of the enemy, who having rallied their scattered forces, and repassed the Po, were encaped at Placentia. Afterwards having concluded a treaty with several of the Gallic cantons, he joined his brother with the rest of the army, and again offered battle to the Romans: but this they thought proper to decline; and at last the consul, being intimidated by the desertion of a body of Gauls, abandoned his camp, passed the Trebia, and posted himself on an eminence near that river. Here he drew lines round his camp, and waited the arrival of his colleague with the forces from Sicily.

Hannibal being apprised of the consul's departure, sent out the Numidian horse to harass him on his march; himself moving with the main body to support them in case of need. The Numidians arriving before the rear of the Roman army had quite passed the Trebia, put to the sword or made prisoners all the stragglers they found there. Soon after, Hannibal coming up, encamped in sight of the Roman army, on the opposite bank. Here having learned the character of the consul Sempronius lately arrived, he soon brought him to an engagement, and entirely defeated him. Ten thousand of the enemy retired to Placentia; but the rest were either killed or taken prisoners. The Carthaginians pursued the flying Romans as far as the Trebia, but did not think proper to repass that river on account of the excessive cold.

112 They are again defeated.

Hannibal, after this action upon the Trebia, ordered the Numidians, Celtiberians, and Lusitanians, to make incursions into the Roman territories, where they committed great devastations. During his state of inaction, he endeavoured to win the affections of the Gauls, and likewise of the allies of the Romans; declaring to the Gallic and Italian prisoners, that he had no intention of making war upon them, being determined to restore them to their liberty, and protect them against the Romans: and to confirm them in their good opinion of him, he dismissed them all without ransom.

113 They are utterly defeated near the lake Thrasymenus.

Next year, having crossed the Apennines, and penetrated into Etruria, Hannibal received intelligence that the new consul Flaminius lay encamped with the Roman army under the walls of Arretium. Having learned the true character of this general, that he was of an haughty, fierce, and rash disposition, he doubted not of being soon able to bring him to a battle. To inflame the impetuous spirit of Flaminius, the Carthaginian general took the road to Rome, and, leaving the Roman army behind him, destroyed all the country through which he passed with fire and sword; and as that part of Italy abounded with all the elegancies as well as necessaries of life, the Romans and their allies suffered an incredible loss on this occasion. The rash consul was inflamed with the utmost rage on seeing the ravages committed by the Carthaginians; and therefore immediately approached them with great temerity, as if certain of victory. Hannibal in the mean time kept on, still advancing towards Rome, having Cortona on the left hand, and the lake Thrasymenus on the right; and at last, having drawn Flaminius into an ambuscade, entirely defeated him. The general himself, with 15,000 of his men, fell on the field of battle. A great number were likewise taken prisoners, and a body of 6000 men, who had fled to a town in Etruria, surrendered to Maherbal the next day. Hannibal lost only 1500 men on this occasion, most of whom were Gauls; though great numbers, both of his soldiers and of the Romans, died of their wounds. 114

114 A Roman detachment cut to pieces or taken.

Being soon after informed that the consul Servilius had detached a body of 4000, or, according to Appian, 8000 horse from Ariminum, to reinforce his colleague in Etruria, Hannibal sent out Maherbal, with all the cavalry, and some of the infantry, to attack him. The Roman detachment consisted of chosen men, and was commanded by Centenius a Patrician. Maherbal had the good fortune to meet with him, and after a short dispute entirely defeated him. Two thousand of the Romans were laid dead on the spot; the rest, retiring to a neighbouring eminence, were surrounded by Maherbal's forces, and obliged next day to surrender at discretion; and this disaster, happening within a few days after the defeat at the lake Thrasymenus, almost gave the finishing stroke to the Roman affairs.

The Carthaginian army was now so much troubled with a scorbutic disorder, owing to the unwholesome encampments they had been obliged to make, and the morasses they had passed through, that Hannibal found it absolutely necessary to repose them for some time in the territory of Adria, a most pleasant and fertile country. In his various engagements with the Romans, he had taken a great number of their arms, with which he now armed his men after the Roman manner. Being now likewise master of that part of the country bordering on the sea, he found means to send an express to Carthage with the news of the glorious progress of his arms. The citizens received this news with the most joyful acclamations, at the same time coming to a resolution to reinforce their armies both in Italy and Spain with a proper number of troops.

115 Fabius Maximus named dictator.

The Romans being now in the utmost consternation, named a dictator, as was their custom in times of great danger. The person they chose to this office was Fabius Maximus, surnamed *Verrucosus*; a man as cool and cautious as Sempronius and Flaminius were warm and impetuous. He set out with a design not to engage Hannibal, but only to watch his motions, and cut off his provisions, which he knew was the most proper way to destroy him in a country so far from his own. Accordingly he followed him through Umbria and Picenum, into the territory of Adria, and then through the territories of the Marrucini and Frentani into Apulia. When the enemy marched, he followed them; when they encamped, he did the same; but for the most part on eminences, and at some distance from their camp, watching all their motions, cutting off their stragglers, and keeping them in a continual alarm. This cautious method of proceeding greatly distressed the Carthaginians, but at the same time raised discontents in his own army. But neither these

these discontents, nor the ravages committed by Hannibal, could prevail upon Fabius to alter his measures. The former, therefore, entered Campania, one of the finest countries of Italy. The ravages he committed there, raised such complaints in the Roman army, that the dictator, for fear of irritating his soldiers, was obliged to pretend a desire of coming to an engagement. Accordingly he followed Hannibal with more expedition than usual; but at the same time avoided, under various pretences, an engagement with more care than the enemy sought it. Hannibal finding he could not by any means bring the dictator to a battle, resolved to quit Campania, which he found abounding more with fruit and wine than corn, and to return to Samnium through the pass called Eribanus. Fabius concluding from his march that this was his design, got there before him, and encamped on Mount Callicula, which commanded the pass, after having placed several bodies in all the avenues leading to it.

116
He is outwitted by Hannibal.

Hannibal was for some time at a loss what to do; but at last contrived the following stratagem, which Fabius could not foresee nor guard against. Being encamped at the foot of Mount Callicula, he ordered Asdrubal to pick out of the cattle taken in the country, 2000 of the strongest and nimblest oxen, to tie faggots to their horns, and to have them and the herdsmen ready without the camp. After supper, when all was quiet, the cattle were brought in good order to the hill, where Fabius had placed some Roman parties in ambush to stop up the pass. Upon a signal given, the faggots on the horns of the oxen were set on fire; and the herdsmen, supported by some battalions armed with small javelins, drove them on quietly. The Romans seeing the light of the fires, imagined that the Carthaginians were marching by torch-light. However, Fabius kept close in his camp, depending on the troops he had placed in ambuscade; but when the oxen, feeling the fire on their heads, began to run up and down the hills, the Romans in ambush thinking themselves surrounded on all sides, and climbing the ways where they saw least light, returned to their camp leaving the pass open to Hannibal. Fabius, though rallied by his soldiers for being thus over-reached by the Carthaginian, still continued to pursue the same plan, marched directly after Hannibal, and encamped on some eminences near him.

Soon after this, the dictator was recalled to Rome; and as Hannibal, notwithstanding the terrible ravages he had committed, had all along spared the lands of Fabius, the latter was suspected of holding a secret correspondence with the enemy. In his absence, Minucius, the general of the horse, gained some advantages, which greatly tended to increase the discontent with the dictator, insomuch that before his return Minucius was put upon an equal footing with himself. The general of the horse proposed that each should command his day; but the dictator chose rather to divide the army, hoping by that means to save at least a part of it. Hannibal soon found means to draw Minucius to an engagement, and, by his masterly skill in laying ambushes, the Roman general was surrounded on every side, and would have been cut off with all his troops, had not Fabius hastened to his assistance, and relieved him. Then the two armies uniting, advanced in good order to renew the fight: but Hannibal, not caring to venture a second action, sounded a retreat, and retired to his camp; and Minucius, being ashamed of his rashness, resigned the command of the army to Fabius.

117
Minucius in great danger is relieved by Fabius.

118
The Romans utterly defeated at Cannæ.

The year following, the Romans augmented their army to 87,000 men, horse and foot; and Hannibal being reduced to the greatest straits for want of provisions, resolved to leave Samnium, and penetrate into the heart of Apulia. Accordingly he decamped in the night; and by leaving fires burning, and tents standing in his camp, made the Romans believe for some time that his retreat was only feigned. When the truth was discovered, Æmilius was against pursuing him: but Terentius, contrary to the opinion of all the officers in the army, except the proconsul Servilius, was obstinately bent on following the enemy; and overtook them at Cannæ, till this time an obscure village in Apulia*. A battle ensued in this place, as memorable as any mentioned in history; in which the Romans, though almost double in number to the Carthaginians, were put to flight with most terrible slaughter; at least 45,000 of them being left dead on the field of battle, and 10,000 taken prisoners in the action or pursuit. The night was spent in Hannibal's camp in feasting and rejoicings, and next day in stripping the dead bodies of the unhappy Romans: after which the victorious general invested their two camps, where he found 4000 men.

* See *Cannæ*.

119
Consequences of this victory.

The immediate consequence of this victory, as Hannibal had foreseen, was a disposition of that part of Italy called the Old Province, Magna Grecia, Tarentum, and part of the territory of Capua, to submit to him. The neighbouring provinces likewise discovered an inclination to shake off the Roman yoke, but wanted first to see whether Hannibal was able to protect them. His first march was into Samnium, being informed that the Hirpini and other neighbouring nations were disposed to enter into an alliance with the Carthaginians. He advanced to Compsa, which opened its gates to him. In this place he left his heavy baggage, as well as the immense plunder he had acquired. After which he ordered his brother Mago, with a body of troops destined for that purpose, to possess himself of all the fortresses in Campania, the most delicious province of Italy. The humanity Hannibal had all along shown the Italian prisoners, as well as the fame of the complete victory he had lately obtained, wrought so powerfully upon the Lucani, Brutii, and Apulians, that they expressed an eager desire of being taken under his protection. Nay, even the Campanians themselves, a nation more obliged to the Romans than any in Italy, except the Latins, discovered an inclination to abandon their natural friends. Of this the Carthaginian general receiving intelligence, he bent his march towards Capua, not doubting, but that, by means of the popular faction there, he should easily make himself master of it; which accordingly happened. Soon after this place had made its submission, many cities of the Brutii opened their gates to Hannibal, who ordered his brother Mago to take possession of them. Mago was then dispatched to Carthage, with the important news of the victory at Cannæ, and the consequences attending it. Upon his

120
Capua submits to Hannibal.

his arrival there, he acquainted the ſenate, that Hannibal had defeated ſix Roman generals, four of whom were conſuls, one dictator, and the other general of horſe to the dictator: that he had engaged ſix conſular armies, killed two conſuls, wounded one, and driven another out of the field with ſcarce 50 men to attend him: that he had routed the general of the horſe, who was of equal power with the conſuls; and that the dictator was eſteemed the only general fit to command an army, merely becauſe he had not the courage to engage him; and as a demonſtrative proof of what he advanced, he produced, according to ſome authors, three buſhels and a half of gold rings, taken from knights and ſenators who had been killed in the various engagements.

121 Mago's account of Hannibal's ſucceſs.

122 Hannibal ſuperior to every other general mentioned in hiſtory.

Hitherto we have ſeen Hannibal ſurpriſingly victorious: and, indeed, if we conſider what he had already done, we ſhall find his exploits ſuperior to thoſe of any other general, either ancient or modern. Other commanders have been celebrated for victories gained over barbarous and uncivilized nations. Alexander the Great invaded and over-ran the empire of Perſia; but that kingdom was then ſunk in ſloth and effeminacy, ſo as to be an eaſy conqueſt: but had the great commander turned his arms againſt the weſtern nations, who were of a more martial diſpoſition, it is more than probable he had not conquered ſo eaſily. Hannibal, on the other hand, lived at a time when the Romans were not only the moſt powerful, but the moſt warlike nation in the whole world. That nation he attacked with an army of only 26,000 men, without reſources either for recruits, money, or proviſions, except what he could procure in the enemies country. With theſe he had for three years reſiſted the Roman armies, which had been hitherto invincible by all other nations. Their armies had been commanded by generals of different tempers, diſpoſitions, and abilities: the loſſes they ſuſtained are by the Roman writers imputed to the faults of the generals themſelves; but experience had abundantly ſhown, that theſe commanders, with all their faults, were able to conquer the moſt warlike nations, when commanded by another than Hannibal. In the battles fought with the Romans he had deſtroyed 200,000 of their men, and taken 50,000 priſoners; yet from the time of the battle of Cannæ, the affairs of this great man totally declined. The reaſon of this is, by the Roman hiſtorians, ſaid to be, that when he put his army into winter-quarters in Capua, he ſo enervated himſelf and his army by debaucheries in that place, that he became no longer capable of coping with the Roman forces. But this ſeems by no means to have been the caſe; for the Roman hiſtorians themſelves own, that, after the battle of Cannæ, he gave their armies many and terrible defeats, and took a great number of towns in their ſight.

123 Cauſe of the decline of his affairs.

The true reaſon of that reverſe of fortune which Hannibal now experienced, was his not having ſufficient reſources for recruiting his army. On the firſt news, indeed, of his ſucceſs at Carthage, a body of 4000 Numidian cavalry, 40 elephants, and 1000 talents of ſilver, were granted by the ſenate. A large detachment of Spaniſh forces was alſo appointed to follow them; and that theſe laſt might be ready in due time, Mago ſet out immediately for Spain to raiſe 20,000 foot and 4000 horſe there. Had this ample ſupply been ſent with proper expedition, it is by no means probable that the Romans would have had any occaſion to reflect upon Hannibal's conduct at Capua. That general would undoubtedly have obliged the haughty republic to ſubmit to the ſuperior force of his arms the next campaign. But, notwithſtanding the influence of the Barcinian faction at Carthage, Hanno and his adherents found means not only to retard the march of the ſupplies intended, but even to diminiſh their number. Mago, through the artifices of that infatuated party, could obtain an order for only 12,000 foot and 2500 horſe, and even with this inconſiderable body of troops he was ſent into Spain. Hannibal being thus deſerted by his country, found himſelf obliged to act on the defenſive; his army amounting to no more now than 26,000 foot and 9000 horſe. But though obliged to act in this mannar, he was only hindred from conquering; the utmoſt efforts of the whole Roman power not being able to drive this ſmall army out of Italy for more than 14 years.

124 Meaſures taken by the Romans.

The Romans, though greatly reduced, were not yet exhauſted. They were able ſtill to ſend two conſular armies into the field, fully recruited and in good order; and as neither the Gauls nor Italians were natural allies of the Carthaginians, they did not fail to abandon them on the firſt reverſe of fortune. After the Romans had recovered from the conſternation into which they were thrown by the defeat at Cannæ, they choſe a dictator, and recalled Marcellus, the conqueror of Syracuſe, from Sicily. All the young Romans, above 17 years of age, of what rank ſoever, were obliged to inliſt themſelves; as were alſo thoſe who had already ſerved their legal time. By this means four legions and 10,000 horſe were ſoon raiſed in the city. The allies of Rome, the colonies, and the municipia, furniſhed the contingence as uſual. To theſe were added 8000 of the youngeſt and ſtrongeſt ſlaves in the city. The republic purchaſed them of their maſters, but did not oblige them to ſerve without their own conſent, which they gave, by anſwering *Volo*, "I am willing;" whence they were called *volones*, to diſtinguiſh them from the other troops. As the Romans, after the loſs of ſo many battles, had no ſwords, darts, or bucklers, left in their magazines, the *volones* were ſupplied with the arms which had been formerly taken from the enemy, and hung up in the public temples and porticoes. The finances of Rome were no leſs exhauſted; but this defect was ſupplied by the liberality of her citizens. The ſenators ſhowing the example, were followed firſt by the knights, and afterwards by all the tribes; who ſtripping themſelves of all the gold they had, brought it to the public treaſury. The ſenators only reſerved their rings, and the *bullæ* about their childrens necks. As for the ſilver coin, it was now, for the firſt time, alloyed with copper, and increaſed in its value. Thus the finances were put into a good condition, and a competent army raiſed.

This was plainly the laſt effort the Romans could make; and could Hannibal have procured a ſufficient ſupply of men and money to enable him to cope with this army, and to break it as he had done the others before, there could have been no more reſiſtance made on their part. He began, however, to be in want of money;

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money; and to procure it gave the Roman prisoners leave to redeem themselves. These unhappy men agreed to send ten of their body to Rome to negociate their redemption; and Hannibal required no other security for their return but their oath. Carthalo was sent at the head of them to make proposals of peace; but upon the first news of his arrival, the dictator sent a lictor to him, commanding him immediately to depart the Roman territory; and it was resolved not to redeem the captives. Upon this Hannibal sent the most considerable of them to Carthage; and of the rest he made gladiators, obliging them to fight with one another, even relations with relations, for the entertainment of his troops.

125
They refuse to treat of peace.

126
Asdrubal defeated by the Romans in Spain.

All this time Cneius and Publius Scipio had carried on the war in Spain with great success against the Carthaginians. Asdrubal had been ordered to enter Italy with his army to assist Hannibal; but being defeated by the Romans, was prevented. The dictator and senate of Rome, encouraged by this news, carried on the preparations for the next campaign with the greatest vigour, whilst Hannibal remained inactive at Capua. This inaction, however, seems to have proceeded from his expectation of succours from Africa, which never came, and which delay occasioned his ruin. The Roman dictator now released from prison all criminals, and persons confined for debt, who were willing to inlist themselves. Of these he formed a body of 6000 foot, armed with the broad swords and bucklers formerly taken from the Gauls. Then the Roman army, to the number of about 25,000 men, marched out of the city, under the command of the dictator; while Marcellus kept the remains of Varro's army, amounting to about 15,000 men, at Casilinum, in readiness to march whenever there should be occasion.

Thus the Roman forces were still superior to those of Hannibal; and as they now saw the necessity of following the example of Fabius Maximus, no engagement of any consequence happened the first year after the battle of Cannæ. Hannibal made a fruitless attempt upon Nola, expecting it would be delivered up to him; but this was prevented by Marcellus, who had entered that city, and sallying unexpectedly from three gates upon the Carthaginians, obliged them to retire in great confusion with the loss of 5000 men. This was the first advantage that had been gained by the Romans where Hannibal had commanded in person, and raised the spirits of the former not a little. They were, however, greatly dejected, on hearing that the consul Posthumius Albinus, with his whole army, had been cut off by the Boii, as he was crossing a forest. Upon this it was resolved to draw all the Roman forces out of Gaul and other countries, and turn them against Hannibal; so that the Carthaginian stood daily more and more in need of those supplies, which yet never arrived from Carthage. He reduced, however, the cities of Nuceria, Casilinum, Petelia, Consentia, Croton, Locri, and several others in Great Greece, before the Romans gained any advantage over him, except that before Nola already mentioned. The Campanians who had espoused the Carthaginian interest, raised an army of 14,000 of their own nation in favour of Hannibal, and put one Marius Alfius at the head of it; but he was surprised by the consul Sempronius, who defeated and killed him with 2000 of his men. It was now found, that Hannibal had concluded a treaty of alliance, offensive and defensive with Philip king of Macedon; but to prevent any disturbance from that quarter, a Roman army was sent to Macedon. Soon after this Marcellus defeated Hannibal in a pitched battle, having armed his men with long pikes used generally at sea, and chiefly in boarding of ships; by which means the Carthaginians were pierced through, while they were totally unable to hurt their adversaries with the short javelins they carried. Marcellus pursued them close; and, before they got to their camp, killed 5000, and took 600 prisoners; losing himself about 1000 men, who were trod down by the Numidian horse, commanded by Hannibal in person. After this defeat the Carthaginian general found himself deserted by 1200 of his best horse, partly Spaniards, and partly Numidians, who had crossed the Alps with him. This touched him so sensibly, that he left Campania, and retired into Apulia.

127
Marcellus gains an advantage over Hannibal.

128
Hannibal takes several cities.

129
He is defeated by Marcellus.

130
He is deserted by a party of horse.

The Romans still continued to increase their forces; and Hannibal, not having the same resources, found it impossible to act against so many armies at once. Fabius Maximus advanced into Campania, whither Hannibal was obliged to return in order to save Capua. He ordered Hanno, however, at the head of 17,000 foot and 1700 horse, to seize Beneventum; but he was utterly defeated, scarce 2000 of his men being left alive. Hannibal himself, in the mean time advanced to Nola, where he was again defeated by Marcellus. He now began to loose ground; the Romans retook Casilinum, Accua in Apulia, Arpi, and Aternum; but the city of Tarentum was delivered up to him by its inhabitants. The Romans then entered Campania, and ravaged the whole country, threatening Capua with a siege. The inhabitants immediately acquainted Hannibal with their danger; but he was so intent upon reducing the citadel of Tarentum, that he could not be prevailed upon to come to their assistance. In the mean time Hanno was again utterly defeated by Fulvius, his camp taken, and he himself forced to fly into Brutium with a small body of horse. The consuls then advanced with a design to besiege Capua in form. But in their way, Sempronius Gracchus, a man of great bravery, and an excellent general, was betrayed by a Lucanian and killed, which proved a very great detriment to the republic. Capua, however, was soon invested on all sides; and the besieged once more sent to Hannibal, who now came to their assistance with his horse, his light-armed infantry, and 33 elephants. He found means to inform the besieged of the time he designed to attack the Romans, ordering them to make a vigorous sally at the same time. The Roman generals, Appius and Fulvius, upon the first news of the enemy's approach, divided their troops, Appius taking upon him to make head against the garrison, and Fulvius to defend the intrenchments against Hannibal. The former found no difficulty in repulsing the garrison; and would have entered the city with them, had he not been wounded at the very gate, which prevented him from pursuing his design. Fulvius found it more difficult to withstand Hannibal, whose troops behaved themselves with extraordinary resolution. A body of Spaniards and

131
He is again defeated and begins to lose ground.

132
Capua besieged by the Romans.

133
Hannibal, in vain, attempts to relieve it.

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Numidians had even the boldness to pass the ditch, and, in spite of all opposition, climbing the ramparts, penetrated into the Roman camp; but not being properly seconded by the rest, they were all to a man cut in pieces. The Carthaginian general was so disheartened at this, especially after the garrison was repulsed, that he sounded a retreat, which was made in good order.

134
He marches to Rome.

His next attempt for the relief of Capua was to march to Rome, where he hoped his approach would strike so much terror, that the armies would be called from before Capua; and that the Capuans might not be disheartened by his sudden departure, he found means to acquaint them with his design. The news of his approach caused great consternation in the metropolis. Some of the senators were for calling all the armies in Italy into the neighbourhood of Rome, as thinking nothing less was able to resist the terrible Carthaginian. But Fabius told them that Hannibal's design was not to take Rome, but relieve Capua; upon which Fulvius was recalled to Rome with 15,000 foot, and 1000 horse; and thus obliged Hannibal again to retire.

135
He surprises and defeats Appius.

He then returned before Capua so suddenly that he surprised Appius in his camp, drove him out of it with the loss of a great number of men, and obliged him to entrench himself on some eminences, where he expected to be soon joined by his colleague Fulvius.

136
Capua submits to the Romans.

As Hannibal, however, now expected to have all the Roman forces upon him, he could do nothing more for the relief of Capua, which was, of consequence, obliged to submit to the Romans.

137
Centenius Penula defeated by Hannibal,

A little before the surrender of Capua, Hannibal came up with a Roman army commanded by one M. Centenius Penula, who had signalized himself on many occasions as a centurion. This rash man being introduced to the senate, had the assurance to tell them, that if they would trust him with a body of only 5000 men, he would give a good account of Hannibal. They gave him 8000, and his army was soon increased to double that number. He engaged the Carthaginians on Hannibal's first offering him battle; but after an engagement of two hours, was defeated, himself and all his men being slain, except about 1000.

138
As also the prætor Fulvius,

Soon after, having found means to draw the prætor Cneius Fulvius into an ambuscade, Hannibal cut in pieces almost his whole army, consisting of 18,000 men. In the mean time Marcellus was making great progress in Samnium. The city of Salapia was betrayed to him; but he took other two by assault. In the last of these he found 3000 Carthaginians, whom he put to the sword; and carried off 240,000 bushels of wheat, and 110,000 of barley.

139
And the pro-consul Fulvius Centumalus.

This, however, was by no means a compensation for the defeat which Hannibal soon after gave the proconsul Fulvius Centumalus, whom he surprised and cut off, with 13,000 of his men.

After this defeat, the great Marcellus advanced with his army to oppose Hannibal. Various engagements happened without any thing decisive. In one of them the Romans are said to have been defeated, and in another Hannibal; but, notwithstanding these, it was neither in the power of Marcellus, nor any other Roman general, totally to defeat or disperse the army commanded by Hannibal in person.

140
Marcellus drawn into an ambuscade and killed.

Nay, in the eleventh year of the war, Hannibal found means to decoy into an ambuscade, and cut off, the great Marcellus himself; the consequence of which was, that the Romans were obliged to raise the siege of Locri, with the loss of all their military engines.

141
Carthaginian affairs totally ruined by the defeat of Asdrubal.

Hitherto the Carthaginians, though no longer the favourites of fortune had lost but little ground; but now they met with a blow which totally ruined their affairs. This was the defeat of Asdrubal, Hannibal's brother, who had left Spain, and was marching to his assistance. He crossed the Pyrenees without any difficulty; and, as the silver mines had supplied him with a very considerable quantity of treasure, he not only prevailed upon the Gauls to grant him a passage through their territories, but likewise to furnish him with a considerable number of recruits. Meeting with many favourable circumstances to expedite his march, he arrived at Placentia sooner than the Romans, or even his brother Hannibal expected. Had he continued to use the same expedition with which he set out, and hastened to join his brother, it would have been utterly impossible to have saved Rome; but, sitting down before Placentia, he gave the Romans an opportunity of assembling all their forces to attack him. At last he was obliged to raise the siege, and began his march for Umbria. He sent a letter to acquaint his brother of his intended motion: but the messenger was intercepted; and the two consuls, joining their armies, with united forces fell upon the Carthaginians. As the latter were inferior both in numbers and resolution, they were utterly defeated, and Asdrubal was killed. About the same time, Hannibal himself is said to have suffered several defeats, and was retired to Canusium: but, on the fatal news of his brother's defeat and death, he was filled with despair, and retired to the extremity of Brutium; where, assembling all his forces, he remained for a considerable time in a state of inaction, the Romans not daring to disturb him, so formidable did they esteem him alone, though every thing about him went to wreck, and the Carthaginian affairs seemed not far from the verge of destruction. Livy tells us, that it was difficult to determine whether his conduct was more wonderful in prosperity or in adversity. Notwithstanding which, Brutium being but a small province, and many of its inhabitants being either forced into the service, or forming themselves into parties of banditti, so that a great part of it remained uncultivated, he found it a difficult matter to subsist there, especially as no manner of supplies were sent him from Carthage. The people there were as solicitous about preserving their possessions in Spain, and as little concerned about the situation of affairs in Italy, as if Hannibal had met with an uninterrupted course of success, and no disaster befallen him since he first entered that country.

142
The great progress of Scipio Africanus.

All their solicitude, however, about the affairs of Spain, was to no purpose: their generals, one after another, were defeated by the Romans. They had indeed cut off the two Scipios; but found a much more formidable enemy in the young Scipio, afterwards surnamed *Africanus*. He overthrew them in conjunction with Masinissa king of Numidia; and the latter, thereafter, abandoned their interest. Soon after, Syphax, king of the Masæsylii, was likewise persuaded to abandon their party. Scipio also gave the Spanish Reguli a great overthrow; and reduced the



cities

Carthage. cities of New Carthage, Gades, and many other important places. At last the Carthaginians began to open their eyes when it was too late. Mago was ordered to abandon Spain, and sail with all expedition to Italy. He landed on the coast of Liguria with an army of 12,000 foot and 200 horse; where he surprised Genoa, and also seized upon the town and port of Savo. A reinforcement was sent him to this place, and new levies went on very briskly in Liguria; but the opportunity was passed, and could not be recalled. Scipio having carried all before him in Spain, passed over into Africa, where he met with no enemy capable of opposing his progress. The Carthaginians then, seeing themselves on the brink of destruction, were obliged to recal their armies from Italy, in order to save their city. Mago, who had entered Insubria, was defeated by the Roman forces there; and having retreated into the maritime parts of Liguria, met a courier who brought him orders to return directly to Carthage. At the same time, Hannibal was likewise recalled. When the messengers acquainted him with the senate's pleasure, he expressed the utmost indignation and concern, groaning, gnashing his teeth, and scarce refraining from tears. Never banished man, according to Livy, showed so much regret in quitting his native country, as Hannibal did at going out of that of the enemy.

143 Mago lands in Italy.

144 Scipio lands in Africa.

145 Mago and Hannibal recalled.

146 Hannibal's proceedings after his arrival in Africa.

The Carthaginian general was no sooner landed in Africa, then he sent out parties to get provisions for the army, and buy horses to remount the cavalry. He entered into a league with the Regulus of the Areacidæ, one of the Numidian tribes. Four thousand of Syphax's horse came over in a body to him; but as he did not think proper to repose any confidence in them, he put them all to the sword, and distributed their horses among his troops. Vermina, one of Syphax's sons, and Masetulus, another Numidian prince, likewise joined him with a considerable body of horse. Most of the fortresses in Masinissa's kingdom either surrendered to him upon the first summons, or were taken by force. Narce, a city of considerable note there, he made himself master of by stratagem. Tychæus, a Numidian Regulus, and faithful ally of Syphax, whose territories were famous for an excellent breed of horses, reinforcing him also with 2000 of his best cavalry, Hannibal advanced to Zama, a town about five day's journey distant from Carthage, where he encamped. He thence sent out spies to observe the posture of the Romans. These being brought to Scipio, he was so far from inflicting any punishment upon them, which he might have done by the laws of war, that he commanded them to be led about the camp, in order to take an exact survey of it, and then dismissed them. Hannibal, admiring the noble assurance of his rival, sent a messenger to desire an interview with him; which, by means of Masinissa, he obtained. The two generals, therefore, escorted by equal detachments of horse, met at Nadagara, where, by the assistance of two interpreters, they held a private conference. Hannibal flattered Scipio in the most refined and artful manner, and expatiated upon all those topics which he thought could influence that general to grant his nation a peace upon tolerable terms; amongst other things, that the Carthaginians would willingly confine themselves to Africa, since such was the will of the gods, in order to procure a lasting peace, whilst the Romans would be at liberty to extend their conquest to the remotest nations. Scipio answered, that the Romans were not prompted by ambition, or any sinister views, to undertake either the former or present war against the Carthaginians; but by justice, and a proper regard for their allies. He also observed that the Carthaginians had, before his arrival in Africa, not only made him the same proposals, but likewise agreed to pay the Romans 5000 talents of silver, restore all the Roman prisoners without ransom, and deliver up all the galleys. He insisted on the perfidious conduct of the Carthaginians, who had broke a truce concluded with them; and told him, that, so far from granting them more favourable terms, they ought to expect more rigorous ones; which if Hannibal would submit to, a peace would ensue; if not, the decision of the dispute must be left to the sword.

147 He has an interview with Scipio.

This conference, betwixt two of the greatest generals the world ever produced, ending without success, they both retired to their respective camps; where they informed their troops, that not only the fate of Rome and Carthage, but that of the whole world, was to be determined by them the next day. An engagement ensued*, in which, as Polybius informs us, the surprising military genius of Hannibal displayed itself in an extraordinary manner. Scipio likewise, according to Livy, passed an high encomium upon him, on account of his uncommon capacity in taking advantages, the excellent arrangement of his forces, and the manner in which he gave his orders during the engagement. The Roman general indeed, not only approved his conduct, but openly declared that it was superior to his own. Nevertheless, being vastly inferior to the enemy in horse, and the state of Carthage obliging him to hazard a battle with the Romans at no small disadvantage, Hannibal was utterly routed, and his camp taken. He fled first to Thon, and afterwards to Adrumentum, from whence he was recalled to Carthage; where being arrived, he advised his countrymen to conclude a peace with Scipio on whatever terms he thought proper to prescribe.

148 The battle of Zama.

*See *Zama*.

149 Hannibal totally routed.

Thus was the second war of the Carthaginians with the Romans concluded. The conditions of peace were very humiliating to the Carthaginians. They were obliged to deliver up all the Roman deserters, fugitive slaves, prisoners of war, and all the Italians whom Hannibal had obliged to follow him. They also delivered up all their ships of war, except ten triremes, all their tame elephants, and were to train up no more of these animals for the service. They were not to engage in any war without the consent of the Romans. They engaged to pay to the Romans, in 50 years, 10,000 Euboic talents, at equal payments. They were to restore to Masinissa all they had usurped from him or his ancestors, and to enter into an alliance with him. They were also to assist the Romans both by sea and land, whenever they were called upon so to do, and never to make any levies either in Gaul or Liguria. These terms appeared so intolerable to the populace, that they threatened to plunder and burn the houses of the nobility; but Hannibal having assembled a body of 6000 foot and 500 horse at Marthama, prevented an

150 Peace concluded.

Carthage. insurrection, and by his influence completed the accommodation.

151 Carthaginians oppressed by Masinissa. The peace between Carthage and Rome was scarce signed, when Masinissa unjustly made himself master of part of the Carthaginian dominions in Africa, under pretence that these formerly belonged to his family. The Carthaginians, through the villanous mediation of the Romans, found themselves under a necessity of ceding these countries to that ambitious prince, and of entering into an alliance with him. The good understanding between the two powers continued for many years afterwards; but at last Masinissa violated the treaties subsisting betwixt him and the Carthaginian republic, and not a little contributed to its subversion.

After the conclusion of the peace, Hannibal still kept up his credit among his countrymen. He was intrusted with the command of an army against some neighbouring nations in Africa; but this being disagreeable to the Romans, he was removed from it, and raised to the dignity of prætor in Carthage. Here he continued for some time, reforming abuses, and putting the affairs of the republic into a better condition; but this likewise being disagreeable to the Romans, he was obliged to fly to Antiochus king of Syria. After his flight, the Romans began to look upon the Carthaginians with a suspicious eye; though, to prevent every thing of this kind, the latter had ordered two ships to pursue Hannibal, had confiscated his effects, rased his house, and by a public decree declared him an exile. Soon after, disputes arising between the Carthaginians and Masinissa, the latter, notwithstanding the manifest iniquity of his proceedings, was supported by the Romans. That prince, grasping at further conquests, endeavoured to embroil the Carthaginians with the Romans, by asserting that the former had received ambassadors from Perseus king of Macedon; that the senate assembled in the temple of Æsculapius in the night-time in order to confer with them; and that ambassadors had been dispatched from Carthage to Perseus, in order to conclude an alliance with him. Not long after this, Masinissa made an irruption into the province of Tysca, where he soon possessed himself of 70, or, as Appian will have it, 50 towns and castles. This obliged the Carthaginians to apply with great importunity to the Roman senate for redress, their hands being so tied up by an article in the last treaty, that they could not repel force by force, in case of an invasion, without their consent. Their ambassadors begged, that the Roman senate would settle once for all what dominions they were to have, that they might from thenceforth know what they had to depend upon; or if their state had any way offended the Romans, they begged that they would punish them themselves, rather than leave them exposed to the insults and vexations of so merciless a tyrant. Then prostrating themselves on the earth, they burst out into tears. But, notwithstanding the impression their speech made, the matter was left undecided; so that Masinissa had liberty to pursue his rapines as much as he pleased. But whatever villanous designs the Romans might have with regard to the republic of Carthage, they affected to show a great regard to the principles of justice and honour. They thererefore sent Cato, a man famous for committing enormities under the specious pretence of public spirit, into Africa, to accommodate all differences betwixt Masinissa and the Carthaginians. The latter very well knew their fate, had they submitted to such a mediation; and therefore appealed to the treaty concluded with Scipio, as the only rule by which their conduct and that of their adversary ought to be examined. This *unreasonable* appeal so incensed the righteous Cato, that he pronounced them a devoted people, and from that time resolved upon their destruction. For some time he was opposed by Scipio Nasica; but the people of Carthage, knowing the Romans to be their inveterate enemies, and reflecting upon the iniquitous treatment they had met with from them ever since the commencement of their disputes with Masinissa, were under great apprehensions of a visit from them. To prevent a rupture as much as possible, by a decree of the senate, they impeached Asdrubal general of the army, and Carthalo commander of the auxiliary forces, together with their accomplices, as guilty of high treason, for being the authors of the war against the king of Numidia. They sent a deputation to Rome, to discover what sentiments were entertained there of their late conduct, and to know what satisfaction the Romans required. These messengers meeting with a cold reception, others were dispatched, who returned with the same success. This made the unhappy citizens of Carthage believe that their destruction was resolved upon; which threw them into the utmost despair. And indeed they had but too just grounds for such a melancholy apprehension, the Roman senate now discovering an inclination to fall in with Cato's measures. About the same time, the city of Utica, being the second in Africa, and famous for its immense riches, as well as its equally commodious and capacious port, submitted to the Romans. Upon the possession of so important a fortress, which, by reason of its vicinity to Carthage, might serve as a place of arms in the attack of that city, the Romans declared war against the Carthaginians without the least hesitation. In consequence of this declaration, the consuls M. Manlius Nepos, and L. Marcius Censorinus, were dispatched with an army and fleet to begin hostilities with the utmost expedition. The land forces consisted of 80,000 foot and 4000 chosen horse; and the fleet of 50 quinqueremes, besides a vast number of transports. The consuls had secret orders from the senate not to conclude the operations but by the destruction of Carthage, without which, it was pretended, the republic could not but look upon all her possessions as insecure. Pursuant to the plan they had formed, the troops were first landed at Lilybæum in Sicily, from whence, after receiving a proper refreshment, it was proposed to transport them to Utica.

152 Hannibal flies to Antiochus.

153 Iniquitous proceedings of Masinissa and the Romans.

154 War declared by the Romans against Carthage.

155 Ambassadors sent to Rome.

The answer brought by the last ambassadors to Carthage had not a little alarmed the inhabitants of that city. But they were not yet acquainted with the resolutions taken at Rome. They therefore sent fresh ambassadors thither, whom they invested with full powers to act as they thought proper for the good of the republic, and even to submit themselves without reserve to the pleasure of the Romans. But the most sensible persons among them did not expect any great success from this condescension, since the early sub-

Carthage. submission of the Uticans had rendered it infinitely less meritorious than it would have been before. However, the Romans seemed to be in some measure satisfied with it, since they promised them their liberty, the enjoyment of their laws, and in short every thing that was dear and valuable to them. This threw them into a transport of joy, and they wanted words to extol the moderation of the Romans. But the senate immediately dashed all their hopes, by acquainting them, that this favour was granted upon condition that they would send 300 young Carthaginian noblemen of the first distinction to the prætor Fabius at Lilybæum, within the space of 30 days, and comply with all the orders of the consuls. These hard terms filled the whole city with inexpressible grief; but the hostages were delivered; and as they arrived at Lilybæum before the 30 days were expired, the ambassadors were not without hopes of softening their hard-hearted enemy. But the consuls only told them, that upon their arrival at Utica they should learn the farther orders of the republic.

156 The Romans demand 300 hostages,

The ministers no sooner received intelligence of the Roman fleet appearing off Utica, then they repaired thither, in order to know the fate of their city. The consuls, however, did not judge it expedient to communicate all the commands of their republic at once, lest they should appear so harsh and severe, that the Carthaginians would have refused to comply with them. They first, therefore, demanded a sufficient supply of corn for the subsistence of their troops. Secondly, That they should deliver up into their hands all the triremes they were then masters of. Thirdly, That they should put them in possession of all their military machines. And fourthly, That they should immediately convey all their arms into the Roman camp.

157 And all the Carthaginian arms, military machines, &c.

As care was taken that there should be a convenient interval of time betwixt every one of these demands, the Carthaginians found themselves ensnared, and could not reject any one of them, though they submitted to the last with the utmost reluctance and concern. Censorinus now imagining them incapable of sustaining a siege commanded them to abandon their city, or, as Zonaras will have it, to demolish it; permitting them to build another 80 stadia from the sea, but without walls or fortifications. This terrible decree threw the senate and every one else into despair; and the whole city became a scene of horror, madness, and confusion. The citizens cursed their ancestors for not dying gloriously in the defence of their country, rather than concluding such ignominious treaties of peace that had been the cause of the deplorable condition to which their posterity was then reduced. At length, when the first commotion was a little abated, the senators assembled, and resolved to sustain a siege. They were stripped of their arms and distitute of provisions; but despair raised their courage, and made them find out expedients. They took care to shut the gates of the city; and gathered together on the ramparts great heaps of stones, to serve them instead of arms in case of a surprise. They took the malefactors out of prison, gave the slaves their liberty, and encorporated them in the militia. Asdrubal was recalled, who had been sentenced to die only to please the Romans; and he was invited to employ 20,000 men he had raised against his country, in defence of it. Another Asdrubal was appointed to command in Carthage; and all seemed resolute, either to save their city or perish in its ruins. They wanted arms; but, by order of the senate, the temples, porticoes, and all public buildings were turned into workhouses, where men and women were continually employed in making arms. As they encouraged one another in their work, and lost no time in procuring to themselves the necessaries of life, which were brought to them at stated hours, they every day made 144 bucklers, 300 swords, 1000 darts, and 500 lances and javelins. As to balistæ and catapultæ, they wanted proper materials for them; but their industry supplied that defect. Where iron and brass were wanting, they made use of silver and gold, melting down the statues, vases, and even the utensils of private families; for, on this occasion, even the most covetous became liberal. As tow and flax were wanting to make cords for working the machines, the women, even those of the first rank, freely cut off their hair and dedicated it to that use. Without the walls, Asdrubal employed the troops in getting together provisions, and conveying them safe into Carthage; so that there was as great a plenty there as in the Roman camp.

158 They command them to destroy their city.

159 The Carthaginians resolve to sustain a siege.

160 They make new arms.

In the mean time the consuls delayed drawing near to Carthage, not doubting but the inhabitants, whom they imagined distitute of necessaries to sustain a siege, would, upon cool reflection, submit; but at length, finding themselves deceived in their expectation, they came before the place and invested it. As they were still persuaded that the Carthaginians had no arms, they flattered themselves that they should easily carry the city by assault. Accordingly they approached the walls in order to plant their scaling-ladders; but to their great surprise they discovered a prodigious multitude of men on the ramparts, shining in the armour they had newly made. The legionaries were so terrified at this unexpected sight, that they drew back, and would have retired, if the consuls had not led them on to the attack: which, however, proved unsuccessful; the Romans, in spite of their utmost efforts, being obliged to give over the enterprize, and lay aside all thoughts of taking Carthage by assault. In the mean time Asdrubal, having collected from all places subject to Carthage a prodigious number of troops, came and encamped within reach of the Romans, and soon reduced them to great straits for want of provisions. As Marcius, one of the Roman consuls, was posted near a marsh, the exhalations of the stagnating waters, and the heat of the season, infected the air, and caused a general sickness among his men. Marcius, therefore, ordered his fleet to draw as near the shore as possible, in order to transport his troops to an healthier place. Asdrubal being informed of this motion, ordered all the old barks in the harbour to be filled with faggots, tow, sulphur, bitumen, and other cumbustible materials; and then taking advantage of the wind, which blew towards the enemy, let them drive upon their ships, which were for the most part consumed. After this disaster, Marcius was called home to preside at the elections; and the Carthaginians looking upon the absence of one of the consuls to be a good omen, made a brisk sally in the night; and would have surprised the consul's camp, had not Æmilianus, with some squadrons, marched out of the

161 The city attacked by the Romans, who are repulsed.

162 Part of the Roman fleet destroyed.

Carthage. gate opposite to the place where the attack was made, and, coming round, fell unexpectedly on their rear, and obliged them to return in disorder to the city.

Asdrubal had posted himself under the walls of a city named Nepheris, 24 miles distant from Carthage, and situated on an high mountain, which seemed inaccessible on all sides. From thence he made incursions into the neighbouring country, intercepted the Roman convoys, fell upon their detachments sent out to forage, and even ordered parties to insult the consular army in their camp. Hereupon the consul resolved to drive the Carthaginian from this advantageous post, and set out for Nepheris. As he drew near the hills, Asdrubal suddenly appeared at the head of his army in order of battle, and fell upon the Romans with incredible fury. The consular army sustained the attack with great resolution; and Asdrubal retired in good order to his post, hoping the Romans would attack him there. But the consul being now convinced of his danger, resolved to retire. This Asdrubal no sooner perceived, than he rushed down the hill, and falling upon the enemy's rear, cut a great number of them in pieces. The whole Roman army was now saved by the bravery of Scipio Æmilianus. At the head of 300 horse, he substained the attack of all the forces commanded by Asdrubal, and covered the legions, while they passed a river in their retreat before the enemy. Then he and his companions threw themselves into the stream and swam across it. When the army had crossed the river, it was perceived that four manipuli were wanting; and soon after they were informed that they had retired to an eminence, where they resolved to sell their lives as dear as possible. Upon this news Æmilianus, taking with him a chosen body of horse, and provisions for two days, crossed the river, and flew to the assistance of his countrymen. He seized an hill over against that on which the four manipuli were posted; and, after some hours repose, marched against the Carthaginians who kept them invested, fell upon them at the head of his squadron with the boldness of a man determined to conquer or die, and in spite of all opposition opened a way for his fellow-soldiers to escape. On his return to the army, his companions, who had given him over for lost, carried him to his quarters in a kind of triumph; and the manipuli he had saved gave him a crown of *gramen*. By these and some other exploits, Æmilianus gained such reputation, that Cato, who is said never to have commended any body before, could not refuse him the praises he deserved; and is said to have foretold that Carthage would never be reduced till Scipio Æmilianus was employed in that expedition.

165 The Roman army, in great danger, is saved by Scipio Æmilianus.

The next year, the war in Africa fell by lot to the consul L. Calpurnius Piso; and he continued to employ Æmilianus in several important enterprises, in which he was attended with uncommon success. He took several castles; and in one of his excursions, found means to have a private conference with Phameas, general, under Asdrubal, of the Carthaginian cavalry, and brought him over, together with 2200 of his horse to the Roman interest. Under the consul Calpurnius Piso himself, however, the Roman arms were unsuccessful. He invested Clupea; but was obliged to abandon the enterprise, with the loss of a great number of men killed by the enemy in their sallies. From this place he went to vent his rage on a city newly built, and thence called *Neapolis*, which professed a strict neutrality, and had even a safeguard from the Romans. The consul, however, plundered the place, and stript the inhabitants of all their effects. After this he laid siege to *Hippagreta*, which employed the Roman fleet and army the whole summer; and, on the approach of winter, the consul retired to Utica, without performing a single action worth notice during the whole campaign.

164 He gains over the Carthaginian general of horse

165 He is chosen consul.

The next year Scipio Æmilianus was chosen consul, and ordered to pass into Africa; and upon his arrival, the face of affairs was greatly changed. At the time of his entering the port of Utica, 3500 Romans were in great danger of being cut in pieces before Carthage. These had seized Megalia, one of the suburbs of the city: but as they had not furnished themselves with provisions to subsist there, and could not retire, being closely invested on all sides by the enemy's troops, the prætor Mancinus, who commanded this detachment, seeing the danger into which he had brought himself, dispatched a light boat to Utica, to acquaint the Romans there with his situation. Æmilianus received this letter a few hours after his landing; and immediately flew to the relief of the besieged Romans, obliged the Carthaginians to retire within their walls, and safely conveyed his countrymen to Utica. Having then drawn together all the troops, Æmilianus applied himself wholly to the siege of the capital.

His first attack was upon Megalia; which he carried by assault, the Carthaginian garrison retiring into the citadel of Byrsa. Asdrubal who had commanded the Carthaginian forces in the field, and was now governor of the city, was so enraged at the loss of Megalia, that he caused all the Roman captives taken in the two years the war lasted, to be brought upon the ramparts and thrown headlong, in the sight of the Roman army, from the top of the wall; after having, with an excess of cruelty, commanded their hands and feet to be cut off, and their eyes and tongues to be torn out. He was of a temper remarkably inhuman, and it is said that he even took pleasure in seeing some of these unhappy men flayed alive. Æmilianus, in the mean time was busy in drawing lines of circumvallation and contravallation cross the neck of land which joined the isthmus on which Carthage stood to the continent. By this means, all the avenues on the landside of Carthage being shut up, the city could receive no provisions that way. His next care was to raise a mole in the sea, in order to block up the old port, the new one being already shut up by the Roman fleet; and this great work he effected with immense labour. The mole reached from the western neck of land, of which the Romans were masters, to the entrance of the port; and was 90 feet broad at the bottom and 80 at the top. The besieged, when the Romans first began this surprising work, laughed at the attempt; but were no less alarmed than surprised, when they beheld a vast mole appearing above water, and by that means the port rendered inaccessible to ships, and quite useless. Prompted by despair, however, the Carthaginians, with incredible and most miraculous industry, dug a new bason, and cut a passage into the sea, by which they could receive the provisions that were sent them by their troops in the field. With the same diligence

166 Cruelties of Asdrubal.

167 Carthage blocked up by sea and land.

168 The besieged dig a new bason.

Carthage.

ligence and expedition, they fitted out a fleet of 50 triremes; which, to the great surprise of the Romans, appeared suddenly advancing into the sea through this new canal, and even ventured to give the enemy battle. The action lasted the whole day, with little advantage on either side. The day after, the consul endeavoured to make himself master of a terrace which covered the city on the side next the sea; and on this occasion the besieged signalized themselves in a most remarkable manner. Great numbers of them, naked and unarmed, went into the water in the dead of the night, with unlighted torches in their hands; and having, partly by swimming, partly by wading, got within reach of the Roman engines, they struck fire, lighted their torches, and threw them with fury against the machines. The sudden appearance of these naked men, who looked like so many monsters started up out of the sea, so terrified the Romans who guarded the machines, that they began to retire in the utmost confusion. The consul, who commanded the detachment in person, and had continued all night at the foot of the terrace, endeavoured to stop his men, and even ordered those who fled to be killed. But the Carthaginians, perceiving the confusion the Romans were in, threw themselves upon them like so many wild beasts; and having put them to flight only with their torches, they set fire to the machines, and entirely consumed them. This, however, did not discourage the consul: he renewed the attack a few days after, carried the terrace by assault, and lodged 4000 men upon it. As this was an important post, because it pent in Carthage on the sea-side, Æmilianus took care to fortify and secure it against the sallies of the enemy; and then, winter approaching, he suspended all further attacks upon the place till the return of good weather. During the winter season, however, the consul was not inactive. The Carthaginians had a very numerous army under the command of one Diogenes, strongly encamped near Nepheris, whence convoys of provisions were sent by sea to the besieged, and brought into the new bason. To take Nepheris, therefore, was to deprive Carthage of her chief magazine. This Æmilianus undertook, and succeeded in the attempt. He first forced the enemy's entrenchments, put 70,000 of them to the sword, and made 10,000 prisoners; all the inhabitants of the country, who could not retire to Carthage, having taken refuge in this camp. After this, he laid siege to Nepheris, which was reduced in 22 days. Asdrubal being disheartened by the defeat of the army, and touched with the misery of the besieged now reduced to the utmost extremity for want of provisions, offered to submit to what conditions the Romans pleased, provided the city was spared; but this was absolutely refused.

169 They set fire to the Roman machines.

170 Vast slaughter of the Carthaginians.

171 Cotho taken.

Early in the spring, Æmilianus renewed the siege of Carthage; and in order to open himself a way into the city, he ordered Lælius to attempt the reduction of Cotho, a small island which divided the two ports. Æmilianus himself made a false attack on the citadel, in order to draw the enemy thither. This stratagem had the desired effect; for the citadel being a place of the greatest importance, most of the Carthaginians hastened thither, and made their utmost efforts to repulse their aggressors. But in the mean time Lælius having, with incredible expedition, built a wooden bridge over the channel which divided Cotho from the isthmus, entered the island, scaled the walls of the fortress which the Carthaginians had built there, and made himself master of that important post. The proconsul, who was engaged before Byrsa, no sooner understood, by the loud shouts of the troops of Lælius, that he had made himself master of Cotho, than he abandoned the false attack, and unexpectedly fell on the neighbouring gate of the city, which he broke down, notwithstanding the showers of darts that were incessantly discharged upon his men from the ramparts. As night coming on prevented him from proceeding farther, he made a lodgment within the gate, and waited there for the return of day, with a design to advance through the city to the citadel, and attack it on that side which was but indifferently fortified. Pursuant to this design, at day-break he ordered 4000 fresh troops to be sent from his camp, and, having solemnly devoted to the infernal gods the unhappy Carthaginians, he began to advance at the head of his men, through the streets of the city, in order to attack the citadel. Having advanced to the market-place, he found that the way to the citadel lay through three exceeding steep streets. The houses on both sides were very high, and filled with Carthaginians, who overwhelmed the Romans as they advanced with darts and stones; so that they could not proceed till they had cleared them. To this end Æmilianus in person, at the head of a detachment, attacked the first house, and made himself master of it sword in hand. His example was followed by the officers and soldiers, who went on from house to house, putting all they met with to the sword. As fast as the houses were cleared on both sides, the Romans advanced in order of battle towards the citadel; but met with a vigorous resistance from the Carthaginians, who on this occasion behaved with uncommon resolution. From the market-place to the citadel, two bodies of men fought their way every step, one above on the roofs of the houses, the other below in the streets. The slaughter was inexpressibly great and dreadful. The air rung with shrieks and lamentations. Some were cut in pieces, others threw themselves down from the tops of the houses; so that the streets were filled with dead and mangled bodies. But the destruction was yet greater, when the proconsul commanded fire to be set to that quarter of the town which lay next to the citadel. Incredible multitudes, who had escaped the swords of the enemy, perished in the flames, or by the fall of the houses. After the fire, which lasted six days, had demolished a sufficient number of houses, Æmilianus ordered the rubbish to be removed, and a large area to be made, where all his troops might have room to act. Then he appeared with his whole army before Byrsa; which so terrified the Carthaginians, who had fled thither for refuge, that first of all 25,000 women, and then 30,000 men, came out of the gates in such a condition as moved pity. They threw themselves prostrate before the Roman general, asking no favour but life. This was readily granted, not only to them, but to all that were in Byrsa, except the Roman deserters, whose number amounted to 900. Asdrubal's wife earnestly intreated her husband to suffer her to join the suppliants, and carry with her to the proconsul her two sons, who were as yet very young; but

Carthage.

172 Romans enter the city.

173 Which is set on fire.

174 Cruelty and cowardice of Asdrubal.

Carthage. but the barbarian denied her request, and rejected her remonstrances with menaces. The Roman deserters seeing themselves excluded from mercy, resolved to die sword in hand, rather than deliver themselves up to the vengeance of their countrymen. Then Asdrubal, finding them all resolved to defend themselves to the last breath, committed to their care his wife and children; after which he, in a most cowardly and mean-spirited manner, came and privately threw himself at the conqueror's feet. The Carthaginians in the citadel no sooner understood that their commander had abandoned the place, than they threw open the gates, and put the Romans in possession of Byrsa. They had now no enemy to contend with but the 900 deserters; who, being reduced to despair, retreated into the temple of Æsculapius, which was as a second temple within the first. There the proconsul attacked them; and these unhappy wretches, finding there was no way to escape, set fire to the temple. As the flames spread, they retreated from one part of the building to another, till they got to the roof. There Asdrubal's wife appeared in her best apparel, and having uttered the most bitter imprecations against her husband, whom she saw standing below with Æmilianus, "Base coward (said she), the mean things thou hast done to save thy life shall not avail thee: thou shalt die this instant, at least in thy two children." Having thus spoken, she stabbed both the infants with a dagger; and while they were yet struggling for life, threw them both from the top of the temple, and then leaped down after them into the flames.

175 Asdrubal's wife destroys herself and two children.

176 Carthage, plundered.

Æmilianus delivered up the city to be plundered, but in the manner prescribed by the Roman military law. The soldiers were allowed to appropriate to themselves all the furniture, utensils, and brass money, they should find in private houses: but all the gold and silver, the statues, pictures, &c. were reserved to be put into the hands of the quæstors. On this occasion the cities of Sicily, which had been often plundered by the Carthaginian armies, recovered a number of statues, pictures, and other valuable monuments: among the rest, the famous brasen bull, which Phalaris had ordered to be cast, and used as the chief instrument of his cruelty, was restored to the inhabitants of Agrigentum. As Æmilianus was greatly inclined to spare what remained of this stately metropolis, he wrote to the senate on the subject, from whom he he received the following orders: 1. The city of Carthage, with Byrsa, and Megalia, shall be entirely destroyed, and no traces of them left. 2. All the cities that have lent Carthage any assistance shall be dismantled. 3. The territories of those cities which have declared for the Romans, shall be enlarged with lands taken from the enemy. 4. All the lands between Hippo and Carthage shall be divided among the inhabitants of Utica. 5. All the Africans of the Carthaginian state, both men and women, shall pay an annual tribute to the Romans at so much per head. 6. The whole country, which was subject to the Carthaginian state, shall be turned into a Roman province, and be governed by a prætor, in the same manner as Sicily. Lastly, Rome shall send commissioners into Africa, there to settle jointly with the proconsul the state of the new province. Before Æmilianus destroyed the city, he performed those religious ceremonies which were required on such occasions: he first sacrificed to the gods, and then caused a plough to be drown round the walls of the city. After this, the towers, ramparts, walls, and all the works which the Carthaginians had raised in the course of many ages, and at a vast expence, were levelled with the ground; and lastly, fire was set to the edifices of the proud metropolis, which consumed them all, not a single house escaping the flames. Though the fire began in all quarters at the same time, and burnt with incredible fury, it continued for 17 days before all the buildings were consumed.

Carthage. 177 And utterly destroyed.

Thus fell Carthage, about 146 years before the birth of Christ; a city whose destruction ought to be attributed more to the intrigues of an abandoned faction, composed of the most profligate part of its citizens, than to the power of its rival. The treasure Æmilianus carried off, even after the city had been delivered up to be plundered by the soldiers, was immense, Pliny making it to amount to 4,470,000 pounds weight of silver. The Romans ordered Carthage never to be inhabited again, denouncing dreadful imprecations against those who, contrary to this prohibition, should attempt to rebuild any part of it, especially Byrsa and Megalia. Notwithstanding this, however, about 24 years after, C. Gracchus, tribune of the people, in order to ingratiate himself with them, undertook to rebuild it; and, to that end, conducted thither a colony of 6000 Roman citizens. The workmen, according to Plutarch, were terrified by many unlucky omens at the time they were tracing the limits and laying the foundations of the new city; which the senate being informed of, would have suspended the attempt. But the tribune, little affected with such presages, continued to carry on the work, and finished it in a few days. From hence it is probable that only a slight kind of huts were erected; but, whether Gracchus executed his design, or the work was entirely discontinued, it is certain, that Carthage was the first Roman colony ever sent out of Italy. According to some authors, Carthage was rebuilt by Julius Cæsar; and Strabo, who flourished in the reign of Tiberius, affirms it in his time to have been equal if not superior to any other city in Africa. It was looked upon as the capital of Africa for several centuries after the commencement of the Christian æra. Maxentius laid it in ashes about the sixth or seventh year of Constantine's reign. Genseric, king of the Vandals, took it A. D. 439; but about a century afterwards it was re-annexed to the Roman empire by the renowned Belisarius. At last the Saracens, under Mohammed's successors, towards the close of the seventh century, so completely destroyed it, that there are now scarce any traces remaining.

178 Rebuilt.

179 Utterly destroyed by the Saracens.

At the commencement of the third Punic war, Carthage appears to have been one of the first cities in the world.—It was seated on a peninsula 360 stadia or 45 miles in circumference, joined to the continent by an isthmus 23 stadia or three miles and a furlong in breadth. On the west side there projected from it a long tract of land half a stadium broad; which shooting out into the sea, separated it from a lake or morass, and was strongly fortified on all sides by rocks and a single wall. In the middle of the city stood the citadel of Byrsa, having on the top of it a temple sacred

180 Its ancient grandeur.

to

Carthage.

to Æsculapius, seated upon rocks on a very high hill, to which the ascent was by 60 steps. On the south side the city was surrounded by a triple wall, 30 cubits high; flanked all round by parapets and towers, placed at equal distances of 480 feet. Every tower had its foundation sunk 32 feet deep, and was four stories high, though the walls were but two: they were arched; and, in the lower part, corresponding in depth with the foundations abovementioned, were stalls large enough to hold 300 elephants with their fodder, &c. Over these were stalls and other conveniences for 4000 horses; and there was likewise room for lodging 20,000 foot and 4000 cavalry, without in the least incommoding the inhabitants. There were two harbours, so disposed as to have a communication with one another. They had one common entrance 70 feet broad, and shut up with chains. The first was appropriated to the merchants; and included in it a vast number of places of refreshment, and all kinds of accommodations for seamen. The second, as well as the island of Cothon, in the midst of it, was lined with large keys, in which were distinct receptacles for securing and sheltering from the weather 220 ships of war. Over these were magazines of all sorts of naval stores. The entrance into each of these receptacles was adorned with two marble pillars of the Ionic order; so that both the harbour and island represented on each side two magnificent galleries. Near this island was a temple of Apollo, in which was a statue of the god all of massy gold; and the inside of the temple all lined with plates of the same metal, weighing 1000 talents. The city was 23 miles in circumference, and at the time we speak of contained 700,000 inhabitants. Of their power we may have some idea, by the quantity of arms they delivered up to the Roman consuls. The whole army was astonished at the long train of carts loaded with them, which were thought sufficient to have armed all Africa. At least it is certain, that on this occasion were put into the hands of the Romans, 2000 catapultæ, 200,000 complete suits of armour, with an innumerable quantity of swords, darts, javelins, arrows, and beams armed with iron which were thrown from the ramparts by the balistæ.

The character transmitted of the Carthaginians is extremely bad; but we have it only on the authority of the Romans, who being their implacable enemies cannot be much relied upon. As to their religion, manners, &c. being much the same with the Phœnicians, of which they were a colony, the reader is referred for an account of these things to the article PHOENICIA.

On the ruins of Carthage there now stands only a small village called *Melcha*. The few remains of Carthage consist only of some fragments of walls and 17 cisterns for the reception of rain water.

There are three eminences, which are so many masses of fine marbles pounded together, and were in all probability the sites of temples and other distinguished buildings. The present ruins are by no means the remains of the ancient city destroyed by the Romans; who after taking it entirely erased it, and plowed up the very foundations: so truly they adhered to the well-known advice perpetually inculcated by Cato the Elder, *Delenda est Carthago*. It was again rebuilt by the Gracchi family, who conducted a colony to re-people it; and continually increasing in splendour, it became at length the capital of Africa under the Roman emperors. It subsisted near 700 years after its first demolition, until it was entirely destroyed by the Saracens in the beginning of the 7th century.

New-Carthage, Carthagena.

It is a singular circumstance that the two cities of Carthage and Rome should have been built just opposite one to the other; the bay of Tunis and the mouth of the Tiber being in a direct line.

*Littora littoribus contraria, fluctibus undas,*
*Arma armis.* VIRG. *Æn*. i. 4.

*New-CARTHAGE*, a considerable town of Mexico, in the province of Costarica. It is a very rich, trading place. W. Long. 86. 7. N. Lat. 9. 5.

CARTHAGENA, a province of South America, and one of the most considerable in New Castile, on account of the great trade carried on by the capital, for the country itself is neither fertile, rich, nor populous. The capital city, called likewise *Carthagena*, is situated in W. Long. 77. N. Lat. 11. on a sandy island, by most writers called a peninsula; which, forming a narrow passage on the south-west, opens a communication with that called *Tierra Bomba*, as far as *Bocca Chica*. The little island which now joins them was formerly the entrance of the bay: but it having been filled up by orders of the court, Bocca Chica became the only entrance: this, however, has been filled up since the attempt of Vernon and Wentworth, and the old passage again opened. On the north side the land is so narrow, that, before the wall was begun, the distance from sea to sea was only 35 toises; but afterwards enlarging, it forms another island on this side; so that, excepting these two places, the whole city is entirely surrounded by salt water. To the eastward it has a communication by means of a wooden bridge, with a large suburb called *Xemani*, built on another island, which is also joined to the continent by a bridge of the same materials. The fortifications both of the city and suburbs are built after the modern manner, and lined with free-stone; and, in time of peace, the garrison consists of ten companies of 77 men each, besides militia. The city and suburbs are well laid out, the streets straight, broad, uniform, and well paved. All the houses are built of stone or brick, only one story high, well contrived, neat, and furnished with balconies and lattices of wood, which is more durable in that climate than iron, the latter being soon corroded by the acrimonious quality of the atmosphere. The climate is exceedingly unhealthy. The Europeans are particularly subject to the terrible disease called the *black vomit*, which sweeps off multitudes annually on the arrival of the galleons. It seldom continues above three or four days; in which time the patient is either dead or out of danger, and if he recovers is never subject to a return of the same distemper.—This disease has hitherto foiled all the art of the Spanish physicians; as has also the leprosy, which is very common here. At Carthagena, lkewise, that painful tumour in the legs, occasioned by the entrance of the *Dracunculus* or Guinea-worm, is very common and troublesome. Another disorder peculiar to this country, and to Peru, is occasioned by a little insect called *Nigua*, so extremely minute, as scarce to be visible to the naked eye. This insect breeds in the dust, insinuates itself into the soles of the feet and the legs, piercing the skin with such subtilty, that there is no being

being aware of it, before it has made its way to the flesh. If it is perceived in the beginning, it is extracted with little pain; but having once lodged its head, and pierced the skin, the patient must undergo the pain of an incision, without which a nodus would be formed, and a multitude of insects ingendered, which would soon overspread the foot and leg. One species of the *nigua* is venomous; and when it enters the toe, an inflammatory swelling, greatly resembling a venereal bubo, takes place in the groin.

CARTHAGENA, a sea-port town of Spain in the kingdom of Murcia, and capital of a territory of the same name; built by Asdrubal, a Carthaginian general, and named after Carthage. It has the best harbour in all Spain, but nothing else very considerable; the bishop's see being transferred to Toledo. In 1706 it was taken by Sir John Leak; but the Duke of Berwick retook it afterwards. W. Long. 0. 58. N. Lat. 37. 36.

CARTHAMUS, in botany: a genus of the order of polygamia æqualis, belonging to the syngenesia class of plants, and in the natural method ranking under the 49th order, *Compositæ*. The calyx is ovate, imbricated with scales, close below, and augmented with subovate foliaceous appendices at top.—Of this genus there are nine species; but the only remarkable one is the tinctorius, with a saffron-coloured flower. This is a native of Egypt and some of the warm parts of Asia. It is at present cultivated in many parts of Europe, and also in the Levant, from whence great quantities of it are annually imported into Britain for the purposes of dyeing and painting. It is an annual plant, and rises with a stiff ligneous stalk, about two feet and a half or three feet in height, dividing upwards into many branches, garnished with oval pointed leaves sitting close to the branches. The flowers grow single at the extremity of each branch; the heads of the flowers are large, inclosed in a scaly impalement; each scale is broad at the base, flat and formed like a leaf of the plant, terminating in a sharp spine. The lower part of the empalement spreads open; but the scales above closely embrace the florets, which are of a fine saffron colour, and are the part used for the purposes abovementioned. The good quality of this commodity is in the colour, which is of a bright saffron hue: and in this the British carthamus very often fails; for if there happens much rain during the time the plants are in flower, the flowers change to a dark or dirty yellow, as they likewise do if the flowers are gathered with any moisture remaining upon them.—The plants are propagated by seeds, which should be sown in drills, at two feet and a half distance from one another, in which the seed should be scattered singly. The plants will appear in less than a month; and in three weeks or a month after, it will be proper to hoe the ground; at which time the plants should be left six inches distant: after this they will require a second hoeing; when they must be thinned to the distance at which they are to remain. If after this they are hoed a third time, they will require no farther care till they come to flower; when, if the safflower is intended for use, the florets should be cut off from the flowers as they come to perfection: but this must be performed when they are perfectly dry; and then they should be dried in a kiln with a moderate fire, in the same manner as the true saffron But in those flowers which are propagated for seed, the florets must be cut off, or the seeds will prove abortive.—The seeds of carthamus have been celebrated as a cathartic; but they operate very slowly, and for the most part disorder the stomach and bowels, especially when given in substance: triturated with distilled aromatic waters, they form an emulsion less offensive, yet inferior in efficacy to the more common purgatives. They are eaten by a species of Egyptian parrot, which is very fond of them; to other birds or beasts they would prove a mortal poison.





CARTHUSIANS, a religious order founded in the year 1080, by one Brudo. The Carthusians, so called from the desert *Chartreux*, the place of their institution, are remarkable for the austerity of their rule. They are not to go out of their cells, except to church, without leave of their superior; nor speak to any person without leave. They must not keep any portion of their meat or drink till next day; their beds are of straw, covered with a felt; their cloathing two hair-cloths, two cowls, two pair of hose, and a cloke, all coarse. In the refectory, they are to keep their eyes on the dish, their hands on the table, their attention on the reader, and their hearts fixed on God. Women are not allowed to come into their churches. It is computed that there are 172 houses of Carthusians; whereof five are of *Nuns*, who practise the same austerities as the Monks. They are divided into 16 provinces, each of which has two visitors. There have been several canonized saints of this order, four cardinals, 70 archbishops and bishops, and a great many very learned writers.

*CARTHUSIAN Powder*, the same with kermes-mineral. See KERMES.

CARTILAGE, in anatomy, a body approaching to the nature of bones; but lubricous, flexible, and elastic. See ANATOMY.

CARTILAGINOUS, in ichthyology, a title given to all fish whose muscles are supported by cartilages instead of bones; and comprehends the same genera of fish to which Linnæus has given the name of *amphibia nantes*: but the word *amphibia* ought properly to be confined to such animals as inhabit both elements; and can live, without any inconvenience, for a considerable time, either on land, or in water; such as tortoises, frogs, and several species of lizards; and, among the quadrupeds, hippopatami, *&c. &c.* *Brit. Zool.* III. 75.

Many of the cartilaginous fish are viviparous, being excluded from an egg, which is hatched within them. The egg consists of a white and a yolk; and is lodged in a case formed of a thick tough substance, not unlike softened horn; such are the eggs of the *ray* and *shark* kinds. Some again differ in this respect, and are oviparous; such are the *sturgeon*, and others.

They breathe either through certain apertures beneath, as in the *rays*; on the sides, as in the *sharks*, &c. or on the top of the head, as in the *pipe-fish*: for they have not covers to their gills like the bony fish.

CARTMEL, a town of Lancashire in England. It is seated among the hills called Carmel-fells, not far from the sea, and near the river Kent; adorned with a very handsome church, built in the form of a cross like a cathedral. The market is well supplied with corn, sheep, and fish. W. Long. 2. 43. N. Lat. 54. 15.

CARTON, or CARTOON, in painting, a design drawn

Carton Cartouche. drawn on ſtrong paper, to be afterwards calked through, and transferred on the freſh plaſter of a wall to be printed in freſco. It is alſo uſed for a deſign coloured, for working in Moſaic, tapeſtry, *&c.* The word is from the Italian *Cartoni, (carti* "paper," and *oni* "large,") denoting many ſheets of paper paſted on canvas, on which large deſigns are made, whether coloured or with chalks only. Of theſe many are to be ſeen at Rome, particularly by Domenichino. Thoſe by Andrea Mantegna, which are at Hampton Court, were made for paintings in the old ducal palace at Mantua. But the moſt famous performances of this ſort are,

The *Cartoons of Raphael,* ſo deſervedly applauded throughout Europe by all authors of refined taſte, and all true admirers of the art of deſign, for their various and matchleſs merit, particularly with regard to the invention, and to the great and noble expreſſion of ſuch a variety of characters, countenances, and moſt expreſſive attitudes, as they are differently affected and properly engaged in every compoſition. Theſe cartoons are ſeven in number, and form only a ſmall part of the ſacred hiſtorical deſigns executed by this great artiſt, while engaged in the chamber of the Vatican under the auſpices of Popes Julius II. and Leo X. When finiſhed, they were ſent to Flanders, to be copied in tapeſtry, for adorning the pontifical apartments: which tapeſtries were not ſent to Rome till ſeveral years after the deceaſe of Raphael, and even in all probability were not finiſhed and ſent there before the terrible ſack of that city in the time of Clement VII. when Raphael's ſcholars were fled from thence, and none left to enquire after the original Cartoons, which lay neglected in the ſtore-rooms of the manufactory. The great revolution alſo which followed in the Low-Countries prevented their being noticed amidſt the entire neglect of the works of art. It was therefore a moſt fortunate circumſtance that theſe ſeven eſcaped the wreck of the others, which were torn in pieces, and remain diſperſed as fragments in differnt collections. Theſe ſeven were purchaſed by Rubens for Charles I. and they have been ſo roughly handled from the firſt, that holes were pricked for the weavers to pounce the outlines, and other parts almoſt cut through in tracing alſo. In this ſtate perhaps they as fortunately eſcaped the ſale amongſt the royal collection, by the diſproportioned appraiſement of theſe ſeven at 300l. and the nine pieces, being the Triumph of Julius Cæſar, by Andrea Mantegna, appraiſed at 1000l. They ſeen to have been taken ſmall notice of till King William built a gallery, purpoſely to receive them, at Hampton Court; whence they were moved on their ſuffering from damps, to the Qeen's Palace. They are now at Windſor Caſtle, and open to public inſpection.

CARTOUCHE, in architecture and ſculpture, an ornament repreſenting a ſcroll of paper. It is uſually a flat member, with wavings, to repreſent ſome inſcription, device, cipher, or ornament of armoury. They are in architecture, much the ſame as modillions; only theſe are ſet under the cornice in wainſcotting, and thoſe under the cornice at the eaves of a houſe.

Cartouche, in the military art, a caſe of wood, about three inches thick at the bottom, girt with marlin, holding about four hundred muſket-balls, beſides ſix or eight balls of iron, of a pound weight, to be fired out of a hobit, for the defence of a paſs, *&c.*

Cartridge Carver. A cartouche is ſometimes made of a globular form, and filled with a ball of a pound weight; and ſometimes it is made for the guns, being of a ball of half or quarter a pound weight, according to the nature of the gun, tied in form of a bunch of grapes, on a tompion of wood and coated over. Theſe were made in the room of partridge-ſhot.

CARTRIDE, in the military art, a caſe of paſteboard or parchment, holding the exact charge of a fire-arm. Thoſe for muſkets, carabines, and piſtols, hold both the powder and ball for the charge; and thoſe of cannon and mortars are uſually in caſes of paſteboard or tin, ſometimes of wood, half a foot long, and adapted to the caliber of the piece.

*Cartridge-Box,* a caſe of wood or turned iron, covered with leather, holding a dozen muſket-cartridges. It is wore upon a belt, and hangs a little lower than the right pocket-hole.

CARTWRIGHT, (William) an eminent divine and poet, born at Northway, near Tewkſbury, in Goaceſterſhire, in September 1611. He finiſhed his education at Oxford; afterwards went into holy orders, and became a moſt florid preacher in the univerſity. In 1642, he had the place of ſuccentor in the church of Saliſbury; and, in 1643, was choſen junior proctor in the univerſity. He was alſo metaphyſical reader there. Wit, judgment, elocution, a graceful perſon and behaviour, occaſioned that encomium of him from dean Fell, "That he was the utmoſt that "man could come to." He was an expert linguiſt; an excellent orator; and at the ſame time was eſteemed an admirable poet. There are extant of his, four plays, and ſome poems. He died in 1643, aged 33.

CARVAGE, *carvagium,* the ſame with Carrucage.

Henry III. is ſaid to have taken carvage, that is two marks of ſilver of every knight's fee, towards the marriage of his ſiſter Iſabella to the emperor. Carvage could only be impoſed on the tenants *in capite.*

Carvage alſo denotes a privilege whereby a man is exempted from the ſervice of carrucage.

CARUCATURIUS, in ancient law books, he that held land in ſoccage, or by plough tenure.

CARUCATE. See Carrucate.

CARVER, a cutter of figures or other devices in wood. See Carving.

Carvers anſwer to what the Romans called *ſculptores,* who were different from *cælotores,* or engravers, as theſe laſt wrought in metal.

Carver is alſo an officer of the table, whoſe buſineſs is to cut up the meat, and diſtribute it to the gueſts. The word is formed from the Latin *carptor,* which ſignifies the ſame. The Romans alſo called him *carpus,* ſometimes *ſciſſor, ſcindendi magiſter,* and *ſtructor.*

In the great families at Rome, the carver was an officer of ſome figure. There were maſters to teach them the art regularly, by means of figures of animals cut in wood. The Greeks alſo had their carvers, called διατροι, q. d. *deribitores* or *diſtributors.* In the primitive times, the maſter of the feaſt carved for all his gueſts. Thus in Homer, when Agamemnon's ambaſſadors were entertained at Achilles's table, the hero himſelf

himſelf carved the meat. Of later times, the ſame office on ſolemn occaſions was executed by ſome of the chief men of Sparta. Some derive the cuſtom of diſtributing to every gueſt his portion, from thoſe early ages when the Greeks firſt left off feeding on acorns, and learned the uſe of corn: The new diet was ſo great a delicacy, that to prevent the gueſts from quarrelling about it, it was found neceſſary to make a fair diſtribution.

In Scotland, the king has a hereditary carver in the family of Anſtruther.

CARUI, or CARVI, in botany. See CARUM.

CARVING, in a general ſenſe, the art or act of cutting or faſhioning a hard body by means of ſome ſharp inſtrument, eſpecially a chiſſel. In this ſenſe carving includes ſtatuary and engraving, as well as cutting in wood.

CARVING, in a more particular ſenſe, is the art of engraving or cutting figures in wood. In this ſenſe *carving*, according to Pliny, is prior both to ſtatuary and painting.

To carve a figure or deſign, it muſt be firſt drawn or paſted on the wood; which done, the reſt of the block, not covered by the lines of the deſign, are to be cut away with little narrow-pointed knives. The wood fitteſt for the uſe is that which is hard, tough, and cloſe, as beech, but eſpecially box: to prepare it for drawing the deſign on, they waſh it over with white-lead tempered in water; which better enables it either to bear ink or the crayon, or even to take the impreſſion by chalking. When the deſign is to be paſted on the wood, this whitening is omitted, and they content themſelves with ſeeing the wood well planed. Then wiping over the printed ſide of the figure with gum tragacanth diſſolved in water, they clap it ſmooth on the wood, and let it dry; which done, they wet it ſlightly over, and fret off the ſurface of the paper gently, till all the ſtrokes of the figure appear diſtinctly. This done, they fall to cutting or carving, as above.

CARUM, in botany: a genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The fruit is ovate, oblong, and ſtriated; the involucrum monophyllous; the petals are carinated or keel-ſhaped below, and emarginated by their inflection.

*Species*, &c. 1. The carui, or caraway of the ſhops, grows naturally in many places of Britain. It is a biennial plant, which riſes from ſeeds one year, flowers the next, and periſhes ſoon after the ſeeds are ripe. It hath a taper root like a parſnip, but much ſmaller, which runs deep into the ground, ſending out many ſmall fibres, and hath a ſtrong aromatic taſte. From the root ariſes one or two ſmooth, ſolid, channelled ſtalks, about two feet high, garniſhed with winged leaves, having long naked foot-ſtalks. 2. The hiſpanicum is alſo a biennial, and is a native of Spain. It riſes with a ſtronger ſtalk than the former, which ſeldom grows more than a foot and a half high; but is cloſely garniſhed with fine narrow leaves like thoſe of dill. Both theſe plants are propagated by ſeeds which ought to be ſown in autumn. Sheep, goats, and ſwine, eat this plant; cows and horſes are not fond of it. Parkinſon ſays, the young roots of caraway are better eating than parſnips. The tender leaves may be boiled with pot herbs. The ſeeds have an aromatic ſmell, and a warm pungent taſte. They are uſed in cakes, incruſted with ſugar, as ſweet-meats, and diſtilled with ſpirituous liquors, for the ſake of the flavour they afford. They are in the number of the four greater hot ſeeds; and frequently employed, as a ſtomachic and carminatives, in flatulent colics and the like.

CARUNCULA, or CARUNCLE, in anatomy, a term denoting a little piece of fleſh, and applied to ſeveral parts of the human body. Thus,

CARUNCULÆ *Myrtiforms*, in anatomy, fleſhy knobs about the ſize of a myrtle berry, ſuppoſed to owe their origin to the breaking of the hymen. See ANATOMY, nº 108.

CARUNCLES in the urethra, proceeding from a gonorrhœa, or an ulceration of the urethra, may be reduced by introducing the BOUGIE.

CARUS, a ſudden deprivation of ſenſe and motion, affecting the whole body. See (the *Index* ſubjoined to) MEDICINE.

CARUS, (Marcus Aurelius) was raiſed from a low ſtation, by his great merit, to be emperor of Rome in 282. He ſhowed himſelf worthy of the empire; ſubdued its enemies, and gave the Romans a proſpect of happy days, when he was unfortunately killed by lightning in 284.

CARWAR, a town of Aſia, on the coaſt of Malabar in the Eaſt-Indies, and where the Engliſh Eaſt-India company have a factory, fortified with two baſtions. The valleys about it abound in corn and pepper, which laſt is the beſt in the Eaſt-Indies. The woods on the mountains abound with quadrupeds, ſuch as tygers, wolves, monkeys, wild hogs, deer, elks, and a ſort of beeves of a prodigious ſize. The religion of the natives is Paganiſm; and they have a great many ſtrange and ſuperſtitious cuſtoms. E. Long. 73. 7. N. Lat. 15. 0.

CAYRA-AE, (Stephanus); *Caryæ, arum*, (Pauſanias) a town of Laconia, between Sparta and the borders of Meſſenia: where ſtood a temple of Diana, thence called *Caryatis, idis;* whoſe annual feſtival, called *Carya, orum*, was celebrated by Spartan virgins with dances. An inhabitant, *Caryates*, and *Caryatis; Caryatis apis* a Laconian bee, (Stephanus.)

*CARYAE-arum*, (anc. geog.) a place in Arcadia towards the borders of Laconia. Whether from this of Arcadia, or that of Laconia, the *Columnæ Caryatides* of Vitruvius and Pliny (which were ſtatues of matrons in ſtoles or long robes) took the appellation, is diſputed.

CARY, (Lucius) Lord viſcount Falkland, was born in Oxfordſhire, about the year 1610; a young nobleman of great abilities and accompliſhments. About the time of his father's death 1633, he was made gentleman of the privy chamber to king Charles I. and afterwards ſecretary of ſtate. Before the aſſembing of the long parliament, he had devoted himſelf to literature, and every pleaſure which a fine genius, a generous diſpoſition, and an opulent fortune, could afford: when called into public life, he ſtood foremoſt in all attacks on the high prerogatives of the crown; but when civil convulſions came to an extremity, and it was neceſſary to chooſe a ſide, he tempered his zeal, Cary, Caryates.

and defended the limited powers that remained to monarchy. Still anxious however for his country, he seems to have dreaded equally the prosperity of the royal party, or that of the parliament; and among his intimate friends, often sadly reiterated the word *peace*. This excellent nobleman freely exposed his person for the king in all hazardous enterprizes, and was killed in the 34th year of his age at the battle of Newberry. In Welwood's memoirs we are told, that whilst he was with the king at Oxford, his majesty went one day to see the public library, where he was shown among other books a Virgil, nobly printed, and exquisitely bound. The lord Falkland, to divert the king, would have his majesty make a trial of his fortune by the Sortes Virgilianæ, an usual kind of divination in ages past, made by opening a Virgil. The king opening the book, the passage which happened to come up, was that part of Dido's imprecation against Æneas, iv. 615, &c. which is thus translated by Dryden.

" Oppress'd with numbers in th' unequal field,
" His men discourag'd, and himself expell'd ;
" Let him for succour sue from place to place,
" Torn from his subjects and his son's embrace," &c.

King Charles seeming concerned at this accident, the lord Falkland, who observed it, would likewise try his own fortune in the same manner; hoping he might fall upon some passage that could have no relation to his case, and thereby divert the king's thoughts from any impression the other might make upon him: but the place lord Falkland stumbled upon was yet more suited to his destiny than the other had been to the king's; being the following expressions of Evander, upon the untimely death of his son Pallas, Æn. xi. 152.

" O Pallas! thou hast fail'd thy plighted word.
" To fight with caution, not to tempt the sword,
" I warn'd thee, but in vain : for well I knew
" What perils youthful ardour would pursue ;
" That boiling blood would carry thee too far ;
" Young as thou wert in dangers, raw to war.
" O curst essay of arms, disast'rous doom,
" Prelude of bloody fields and fights to come !"

He wrote several things, both poetical and political; and in some of the king's declarations, supposed to be penned by lord Falkland, we find the first regular definition of the English constitution that occurs in any composition published by authority. His predecessor, the first viscount Cary, was ennobled for being the first who gave king James an account of queen Elizabeth's death.

Cary, (Robert) a learned English chronologer, born in Devonshire about the year 1615. On the restoration, he was preferred to the archdeaconry of Exeter; but on some pretext was ejected in 1664, and spent the rest of his days at his rectory of Portlemouth, where he died in 1688. He published *Palælogia Chronica*, a chronology of ancient times, in three parts, didactical, apodeictical, and canonical; and translated the hymns of the church into Latin verse.

CARYATES, in antiquity, a festival in honour of Diana surnamed *Caryatis*, held at Caryum, a city of Laconia. The chief ceremony was a certain dance, said to have been invented by Castor and Pollux, and per-

Caryatides || Caryophyllæi.

formed by the virgins of the place. During Xerxes's invasion, the Laconians not daring to appear and celebrate the customary solemnity, to prevent incurring the anger of the goddess by such an intermission, the neighbouring swains are said to have assembled and sung pastorals or *bucclismi*, which is said to have been the origin of *bucolic* poetry.

CARYATIDES, or Caraites. See Architecture, n° 56.

CARYL, (Joseph) a divine of the last century, bred at Oxford, and some time preacher to the society of Lincoln's inn, an employment he filled with much applause. He became a frequent preacher before the long parliaments, a licenser of their books, one of the assembly of divines, and one of the triers for the approbation of ministers; in all which capacities he shewed himself a man of considerable parts and learning, but with great zeal against the king's person and cause. On the restoration of Charles II. he was silenced by the act of uniformity, and lived privately in London, where, besides other works, he distinguished himself by a laborious *Exposition of the Book of Job*; and died in 1672.

CARYLL, (John) a late English poet, was of the Roman Catholic persuasion, being secretary to queen Mary the wife of James II. and one who followed the fortunes of his abdicating master; who rewarded him, first with knighthood, and then with the honorary titles of earl Caryll and baron Dartford. How long he continued in that service is not known; but he was in England in the reign of queen Anne, and recommended the subject of the "Rape of the Lock" to Mr Pope, who at its publication addressed it to him. He was also the intimate friend of Pope's "Unfortunate Lady." He was the author of two plays: 1. "The English Princess, or the Death of Richard III. 1667," 4to.; 2. "Sir Salomon, or the Cautious Coxcomb, 1671," 4to.; and in 1700, he published "The Psalms of David, translated from the Vulgat," 12mo. In Tonson's edition of Ovid's Epistles, that of "Briseis to Achilles" is said to be by Sir John Caryll; and in Nichols's Select Collection of Miscellany Poems, vol. II. p. 1. the first Eclogue of Virgil is translated by the same ingenious poet. He was living in 1717, and at that time must have been a very old man. See three of his letters in the "Additions to Pope," vol. II. p. 114.

CARYOCAR, in botany: A genus of the tetragynia order, belonging to the polyandria class of plants. The calyx is quinquepartite, the petals five, the styles more frequently four. The fruit is a plum, with necleusses, and four furrows netted.

CARYOPHYLLÆI, in botany, the name of a very numerous family or order in Linnæus's fragments of a natural method: containing, besides the class of the same name in Tournefort, many other plants, which from their general appearance seem pretty nearly allied to it. The following are the genera, *viz.* Agrostema, Cucubalus, Dianthus, Drypis, Gypsophila, Lychnis, Saponaria, Silene, Velazia, Alsine, Arenaria, Busonia, Cerastium, Cherleria, Glinus, Holesteum, Leoslingia, Moehringia, Polycarpon, Sagina, Spergula, Stellaria, Minuartia, Mollugo, Ortegia, Pharnaceum, Queria. All the plants of this order are herbaceous,

 and

and mostly annual. Some of the creeping kinds do not rise an inch, and the tallest exceed not seven or eight feet. See BOTANY, sect. vi. 22.

CARYOPHYLLUS, the PINK, in botany. See DIANTHUS.

CARYOPHYLLUS, the CLOVE-TREE, in botany: A genus of the monogynia order, belonging to the polyandria class of plants; and in the natural method ranking under the 19th order, *Hesperideæ*. The corolla is tetrapetalous; the calyx tetraphyllous; the berry monospermous below the receptacle of the flower. Of this there is but one species, viz. the aromaticus, which is a native of the Molucca islands, particularly of Amboyna, where it is principally cultivated. The clove-tree resembles, in its bark, the olive; and is about the height of the laurel, which it also resembles in its leaves. No verdure is ever seen under it. It has a great number of branches, at the extremities of which are produced vast quantities of flowers, that are first white, then green, and at last pretty red and hard. When they arrive at this degree of maturity, they are, properly speaking, *cloves*. As they dry, they assume a dark yellowish cast; and, when gathered, become of a deep brown. The season for gathering the cloves is from October to February. The boughs of the trees are then strongly shaken, or the cloves beat down with long reeds. Large cloths are spread to receive them, and they are aftewards either dried in the sun or in the smoke of the bamboo-cane. The cloves which escape the notice of those who gather them, or are purposely left upon the tree, continue to grow till they are about an inch in thickness; and these falling off, produce new plants, which do not bear in less than eight or nine years. Those which are called *mother-cloves* are inferior to the common sort; but are preserved in sugar by the Dutch; and, in long voyages, eat after their meals, to promote digestion.

The clove, to be in perfection, must be full sized, heavy, oily, and easily broken; of a fine smell, and of a hot aromatic taste, so as almost to burn the throat. It should make the fingers smart when handled, and leave an oily moisture upon them when pressed. In the East Indies, and in some parts of Europe, it is so much admired as to be thought an indispensable ingredient in almost every dish. It is put into their food, liquors, wines, and enters likewise the composition of their perfumes. Considered as medicines, cloves are very hot, stimulating, aromatics; and possess in an eminent degree the general virtues of substances of this class. Their pungency resides in their resin; or rather in a combination of resin with essential oil: for the spirituous extract is very pungent; but if the oil and the resin contained in this extract are separated from each other by distillation, the oil will be very mild; and any pungency which it does retain, proceeds from some small portion of adhering resin, and the remaining resin will be insipid. No plant, or part of any plant, contains such a quantity of oil as cloves do. From 16 ounces Newman obtained by distillation two ounces and two drams, and Hoffman obtained an ounce and a half of oil from two ounces of the spice. The oil is specifically heavier than water. Cloves acquire weight by imbibing water; and this they will do at some considerable distance. The Dutch, who trade in cloves, make a considerable advantage by knowing this secret. They sell them always by weight; and when a bag of cloves is ordered, they hang it, for several hours before it is sent in, over a vessel of water, at about two feet distance from the surface. This will add many pounds to the weight, which the unwary purchaser pays for on the spot. This is sometimes practised in Europe, as well as in the spice islands: but the degree of moisture must be more carefully watched in the latter; for there a bag of cloves will, in one night's time, attract so much water, that it may be pressed out of them by squeezing them with the hand.

The clove-tree is never cultivated in Europe. At Amboyna the company have allotted the inhabitants 4000 parcels of land, on each of which they were at first allowed, and about the year 1720 compelled, to plant about 125 trees, amounting in all to 500,000. Each of these trees produces annually on an average more than two pounds of cloves; and consequently the collective produce must weigh more than a million. The cultivator is paid with the specie that is constantly returned to the company, and receives some unbleached cottons which are brought from Coromandel.

CARYOTA, in botany: A genus belonging to the natural order of *Palmæ*. The male calyx is common, the corolla tripartite; the stamina very numerous: the female calyx the same; the corolla tripertite; one pestil, and a dispermous berry.

CASA, in ancient and middle-age writers, is used to denote a cottage or house.

*CASA Santa*, denotes the chapel of the holy virgin at Loretto.—The *Santa Casa* is properly the house, or rather chamber, in which the blessed virgin is said to have been born, where she was betrothed to her spouse Joseph, where the angel saluted her, the Holy Ghost overshadowed her, and by consequence where the Son of God was conceived or incarnated. Of this building the Catholics tell many wonderful stories too childish to transcribe. The *Santa Casa* or holy chamber consists of one room, forty-four spans long, eighteen broad, and twenty-three high. Over the chimney, in a niche, stands the image called the great *Madona* or Lady, four feet high, made of cedar, and, as they say, wrought by St Luke, who was a carver as well as a physician. The mantle or robe she has on, is covered with innumerable jewels of inestimable value. She has a crown, given her by Louis XIII. of France, and a little crown for her son.

CASAL, a strong town of Italy in Mountferrat, with a citadel and a bishop's see. It was taken by the French from the Spaniards in 1640; and the duke of Mantua sold it to the French in 1681. In 1695 it was taken by the allies, who demolished the fortifications; but the French retook it, and fortified it again. The king of Sardinia became master of it in 1706, from whom the French took it in 1745; however, the king of Sardinia got possession again in 1746. It is seated on the river Po, in E. Long. 8. 37. N. Lat. 54. 7.

*CASAL-Maggiore*, a small strong town of Italy, in the duchy of Milan, seated on the river Po. E. Long. 11. 5. N. Lat. 45. 6.

CASA-NOVA, (Marc Antony) a Latin poet, born

at

at Rome, succeeded particularly in epigrams. The poems he composed in honour of the illustrious men of Rome are also much esteemed. He died in 1527.

CASAN, a considerable town of Asia, and capital of a kingdom of the same name in the Russian empire, with a strong castle, a citadel, and an archbishop's see. The country about it is very fertile in all sorts of fruits, corn, and pulse. It carries on a great trade in furs, and furnishes wood for the building of ships. The kingdom of Casan is bounded on the north by Permia, on the east by Siberia, on the south by the river Wolga, and on the west by the province of Moscow. E. Long. 53. 25. N. Lat. 55. 38.

CASAS, (Bartholomew de las) bishop of Chiapa, distinguished for his humanity and zeal for the conversion of the Indians, was born at Seville in 1474; and went with his father, who sailed to America, with Christopher Columbus in 1493. At his return to Spain he embraced the state of an ecclesiastic, and obtained a curacy in the island of Cuba; but some time after quitted his cure in order to procure liberty for the Indians, whom he saw treated by the Spaniards in the most cruel and barbarous manner, which naturally gave them an unconquerable aversion to Christianity. Bartholomew exerted himself with extraordinary zeal, for 50 years together, in his endeavours to persuade the Spaniards that they ought to treat the Indians with equity and mildness; for which he suffered a number of persecutions from his countrymen. At last the court, moved by his continual remonstrances, made laws in favour of the Indians, and gave orders to the governors to observe them, and see them executed*. He died at Madrid in 1566, aged 92. He wrote several works, which breathe nothing but humanity and virtue. The principal of them are, 1. An account of the destruction of the Indies. 2. Several treatises in favour of the Indies, against Dr Sepulveda, who wrote a book to justify the inhuman barbarities committed by the Spaniards. 3. A very curious, and now scarce, work in Latin, on this question, "Whether kings or princes can, consistently with conscience, or in virtue of any right or title, alienate their subjects, and place them under the dominion of another sovereign?"

* See the article *Mexico*.

CASATI, (Paul) a learned Jesuit, born at Placentia in 1617, entered early among the Jesuits; and, after having taught mathematics and divinity at Rome, was sent into Sweden to queen Christina, whom he prevailed on to embrace the popish religion. He wrote, 1. *Vacuum proscriptum*. 2. *Terra machinis mota*. 3. *Mechanicorum, libri octo*. 4. *De Igne Dissertationes;* which is much esteemed. 5 *De Angelis Disputatio Theolog*. 6. *Hydrostaticæ Dissertationes*. 7. *Opticæ Disputationes:* It is remarkable that he wrote this treatise on optics at 88 years of age, and after he was blind. He also wrote several books in Italian.

CASAUBON, (Isaac) was born at Geneva in 1559; and Henry IV. appointed him his library-keeper in 1603. After this prince's death, he went into England with Sir Henry Wotton, ambassador from King James I. where he was kindly received and engaged in writing against Baronius's annals: he died not long after this, in 1614; and was interred in Westminster-abbey, where a monument was erected to him. He was greatly skilled in the Greek and in criticism; published several valuable commentaries; and received the highest elogiums from all his cotemporaries.



CASAUBON, (Meric) son of the preceding, was born at Geneva in 1599. He was bred at Oxford, and took the degree of master of arts in 1621. The same year he published a book in defence of his father against the calumnies of certain Roman Catholics; which gained him the favour of King James I. and a considerable reputation abroad. He was made prebendary of Canterbury by archbishop Laud. In the beginning of the civil war he lost all his spiritual promotions, but still continued to publish excellent works. Oliver Cromwell, then lieutenant-general of the parliament's forces, would have employed his pen in writing the history of the late war; but he declined it, owning that his subject would oblige him to make such reflections as would be ungrateful, if not injurious, to his lordship. Notwithstanding this answer, Cromwell, sensible of his worth, ordered three or four hundred pounds to be paid him by a bookseller in London whose name was Cromwell, on demand, without requiring from him any acknowledgment of his benefactor. But this offer he rejected, though his circumstances were then mean. At the same time it was proposed by his friend Mr Greaves, who belonged to the library at St James's, that, if Casaubon would gratify Cromwell in the request abovementioned, all his father's books which were then in the royal library, having been purchased by King James, should be restored to him, and a pension of 300 *l*. a-year paid to the family as long as the youngest son of Dr Casaubon should live; but this also was refused. He likewise refused handsome offers from Christina queen of Sweden, being determined to spend the remainder of his life in England. At the restoration he recovered all his preferments, and continued writing till his death in 1671. He was the author of an English translation of Marcus Aurelius Antoninus's meditations, and of Lucius Florus; editions of several of the classics, with notes; a treatise of use and custom; a treatise of enthusiasm: with many other works; and he left a number of MSS. to the university of Oxford.

CASAURINA, in botany: A genus of the monandria order, belonging to the monoecia class of plants. The male has the calyx of the amentum; the corolla a bipartite small scale. The female has a calyx of the amentum, no corolla; the style bipartite.

CASCADE, a steep fall of water from a higher into a lower place. The word is French, formed of the Italian *cascata*, which signified the same; of *cascare*, *to fall;* and that from the Latin *cadere*.

Cascades are either natural, as that at Tivoli, &c. or artificial, as those of Versailles, &c. and either falling with gentle descent, as those of Sceaux; or in form of a buffet, as at Trianon; or down steps, in form of a perron, as at St Clou; or from bason to bason, &c.

CASCAIS, a town of Estremadura in Portugal, situated at the mouth of the river Tagus, 17 miles east of Lisbon. W. Long. 10. 15. N. Lat. 38. 40.

CASCARILLA. See CLUTIA and CROTON.

CASE, among grammarians, implies the different inflections

inflections or terminations of nouns, serving to express the different relations they bear to each other, and to the things they represent. See GRAMMAR.

CASE also denotes a receptacle for various articles; as a case of knives, of lancets, of pistols, &c.

CASE, in printing, a large flat oblong frame placed aslope, divided into several compartments or little square cells; in each of which are lodged a number of types or letters of the same kind, whence the compositor takes them out, each as he needs it, to compose his matter. See PRINTING.

CASE is also used for a certain numerous quantity of divers things. Thus a case of crown-glass contains usually 24 tables, each table being nearly circular, and about three feet six inches diameter; of Newcastle glass, 35 tables; of Normandy glass, 25.

*CASE-Hardening of Iron*, is a superficial conversion of that metal into steel, by the ordinary method of conversion, namely by cementation with vegetable or animal coals. This operation is generally practised upon small pieces of iron wrought into tools and instruments to which a superficial conversion is sufficient; and it may be performed conveniently by putting the pieces of iron to be case-hardened, together with the cement, into an iron box, which is to be closely shut and exposed to a red heat during some hours. By this cementation a certain thickness from the surface of the iron will be converted into steel, and a proper hardness may be afterwards given by sudden extinction of the heated pieces of converted iron in a cold fluid. See STEEL.

*CASE-Shot*, in the military art, musket-balls, stones, old iron, &c. put into cases, and shot out of great guns.

CASEMENT, or CASEMATE, in architecture, a hollow moulding, which some architects make one-sixth of a circle, and others one-fourth.

CASEMENT is also used in building, for a little moveable window, usually within a larger, being made to open or turn on hinges.

CASERN, in fortification, lodgings built in garrison-towns, generally near the rampart, or in the waste places of the town, for lodging soldiers of the garrison. There are usually two beds in each casern for six soldiers to lie, who mount the guard alternately; the third part being always on duty.

CASERTA, an episcopal town of Italy in the kingdom of Naples, and in the Terra di-Lavoro, with the title of a duchy, seated at the foot of a mountain of the same name, in E. Long. 15. 5. N. Lat. 41. 5.

CASES, (Peter-James) of Paris, the most eminent painter of the French school; the churches of Paris and of Versailles abound with his works. He died in 1754, aged 79.

CASH, in a commercial style, signifies the stock or ready money which a merchant or other person has in his present disposal to negociate; so called from the French term *caisse*, i. e. *chest* or *coffer* for the keeping of money.

M. Savary shows that the management of the cash of a company is the most considerable article, and that whereon its good or ill success chiefly depends.

*CASH-Book*. See BOOK-KEEPING.

CASHEL, or CASHIL, a town of Ireland in the county of Tipperary, and province of Munster, with an archbishop's see. The ruins of the old cathedral testify its having been an extensive as well as handsome Gothic structure, boldly towering on the celebrated rock of Cashel, which taken together form a magnificient oject, and bear honourable testimony to the labour and ingenuity, as well as the piety and zeal, of its former inhabitants. It is seen at a great distance, and in many directions. Adjoining it are the ruins of the chapel of Cormac M'Culinan, at once king and archbishop of Cashel, supposed to be the first stone building in Ireland; and seems, by its rude imitation of pillars and capitals, to have been copied after the Grecian architecture, and long to have preceded that which is usually called *Gothic*. Cormac M'Culinan was a prince greatly celebrated by the Irish historians for his learning, piety, and valour. He wrote, in his native language, a history of Ireland, commonly called the *Psalter of Cashel*, which is still extant, and contains the most authentic account we have of the annals of the country to that period, about the year 900. On the top of the rock of Cashel, and adjoining the cathedral, is a lofty round tower, which proudly defied the too successful attempts of archbishop Price, who in this century unroofed and thereby demolished the ancient cathedral founded by St Patrick. In the choir are the monuments of Myler Magrath, archbishop of this see in the reign of queen Elizabeth, and some other curious remains of antiquity. Cashel was formerly the royal seat and metropolis of the kings of Munster; and on the ascent to the cathedral is a large stone on which every new king of Munster was, as the inhabitants report from tradition, solemnly proclaimed. Cashel is at present but small to what we may suppose it to have been in ancient days. The archbishop's palace is a fine building. Here is a very handsome market house, a sessions house, the county infirmary, a charter school for twenty boys and the same number of girls, and a very good barrack for two companies of foot. The present archbishop Dr Agar hath finished a very elegant church begun by his predecessor. W. Long. 7. 36. N. Lat. 52. 16.



CASHEW-NUT. See ANACARDIUM.

CASHIER, the cash-keeper; he who is charged with the receiving and paying the debts of a society.—In the generality of foundations, the cashier is called *treasurer*.

*CASHIERS of the Bank*, are officers who sign the notes that are issued out, examine and mark them when returned for payment, &c.

CASHMIRE, a province of Asia in the dominions of the Mogul. It is situated at the extremity of Hindostan, northward of Lahore, and is bounded on the one side by a ridge of the great Caucasus, and on the other by the little Tartarian Thibet and Moultan. The extent of it is not very considerable; but being girt in by a zone of hills, and elevated very considerably above an arid plain, which stretches many miles around it, the scenes which it exhibits are wild and picturesque. Rivers, hills, and valleys, charmingly diversify the landscape. Here, Mr Sullivan† informs us, a cascade rushes from a foaming precipice; there a tranquil stream glides placidly along; the tinkling rill, too, sounds amidst the groves; and the feathered choristers sing the song of love, close sheltered in the glade.

† *Philosophical Rhapsodies.*

At

Cashmire ‖ Casing.

At what time Cashmire came under the dominion of the Mogul government, and how long, and in what manner it was independent, before it was annexed to the territories of the house of Timur, are points that are beyond our present purpose. Though inconsiderable as to its revenues, it was uniformly held in the highest estimation by the emperors of Hindostan. Thither they repaired, in the plenitude of their greatness, when the affairs of state would admit of their absence; and there they divested themselves of form and all the oppressive ceremony of state. The royal manner of travelling to Cashmire was grand, though tedious and unwieldy, and showed, in an eminent degree, the splendour and magnificence of an eastern potentate. Aurungzebe, we are told, seldom began his march to that country, for a march certainly it was to be called, without an escort of 80,000 or 100,000 fighting men, besides the gentlemen of his household, the attendants of his seraglio, and most of his officers of state. These all continued with him during the time he was on the road, which generally was a month: but no sooner was he arrived at the entrance of those aërial regions, than, with a select party of friends, he separated from the rest of his retinue, and with them ascended the defiles which led him to his Eden.

The temperature of the air of Cashmire, elevated as it is so much above the adjoining country, together with the streams which continually pour from its mountains, enables the husbandman to cultivate with success the soil he appropriates to agriculture; whilst the gardener's labour is amply repaid in the abundant produce of his fruit. In short, nature wears her gayest cloathing in this enchanting spot. The rivers supply the inhabitants with almost every species of fish; the hills yield sweet herbage for the cattle; the plains are covered with grain of different denominations; and the woods are stored with variety of game. The Cashmireans, according to our author, seem a race distinct from all others in the East: their persons are more elegant, and their complexions more delicate and more tinged with red.

On the decadence of the Mogul power in Hindostan, Cashmire felt some of the ravages of war. It is now however in peace; and the inhabitants are desirous of keeping it so. They are sprightly and ingenious; and have several curious manufactures much valued in India. They are all Mahometans or Idolaters. Cashmire is the capital town.

CASIMIR, the name of several kings of Poland. See *(History of)* POLAND.

CASIMIR, (Matthias Sorbiewski) a Polish Jesuit, born in 1597. He was a most excellent poet; and is, says M. Baillet, an exception to the general rule of Aristotle and the other ancients, which teaches us to expect nothing ingenious and delicate from northern climates. His odes, epodes, and epigrams, have been thought not inferior to those of the finest wits of Greece and Rome. Dr Watts has translated one or two of his small pieces, which are added to his Lyric Poems. He died at Warsaw in 1640, aged 43. There have been many editions of his poems, the best of which is that of Paris, 1759.

CASING *of* TIMBER-WORK, among builders, is the plastering the house all over the outside with mortar, and then striking it while wet by a ruler, with the corner of a trowel, to make it resemble the joints of free-stone. Some direct it to be done upon heart-laths, because the mortar would, in a little time, decay the sap-laths; and to lay on the mortar in two thicknesses, *viz.* a second before the first is dry.

Cask ‖ Caslon.

CASK, a piece of defensive armour wherewith to cover the head and neck; otherwise called the *head-piece* and *helmet**. The word is French, *casque*, from *cassicum* or *cassicus*, a diminutive of *cassis* a helmet. Le Gendre observes, that anciently, in France, the gens d'arms all wore *casks*. The king wore a *cask* gilt; the dukes and counts silvered; gentlemen of extraction polished steel; and the rest plain iron.

* See *Helmet.*

The cask is frequently seen on ancient medals, where we may observe great varieties in the form and fashion thereof; as the Greek fashion, the Roman fashion, *&c.* F. Joubert makes it the most ancient of all the coverings of the head, as well as the most universal. Kings, emperors, and even gods themselves, are seen therewith. That which covers the head of Rome has usually two wings like those of Mercury: and that of some kings is furnished with horns like those of Jupiter Ammon; and sometimes barely bulls or rams horns, to express uncommon force.

CASK, in heraldry, the same with helmet. See HERALDRY, n° 45.

CASK, a vessel of capacity, for preserving liquors of divers kinds; and sometimes also dry goods, as sugar, almonds, *&c.*—A cask of sugar is a barrel of that commodity, containing from eight to eleven hundred weight. A cask of almonds is about three hundred weight.

CASKET, in a general sense, a little coffer or cabinet. See CABINET.

CASKETS, in the sea language, are small ropes made of sinnet, and fastened to gromets, or little rings upon the yards; their use is to make fast the sail to the yard when it is to be furled.

CASLON, (William) eminent in an art of the greatest consequence to literature, the art of letter-founding, was born in 1692, in that part of the town of Hales Owen which is situated in Shropshire. Tho' he justly attained the character of being the Coryphæus in that employment, he was not brought up to the business; and it is observed by Mr Mores, that this handy-work is so concealed among the artificers of it, that he could not discover that any one had taught it to another, but every person who had used it had learned it of his own genuine inclination. Mr Caslon served a regular apprenticeship to an engraver of ornaments on gun-barrels; and after the expiration of his term, carried on this trade in Vine-street, near the Minories. He did not, however, solely confine his ingenuity to that instrument; but employed himself likewise in making tools for the book-binders, and for the chasing of silver plate. Whilst he was engaged in this business, the elder Mr Bowyer accidentally saw, in a bookseller's shop, the lettering of a book uncommonly neat; and enquiring who the artist was by whom the letters were made, was hence induced to seek an acquaintance with Mr Caslon. Not long after, Mr Bowyer took Mr Caslon to Mr James's foundery, in Bartholomew-close. Caslon had never before that time seen any part of the business; and being asked by his friend, if he thought he could undertake to cut types, he

*Biog. Brit.* and *Anecdotes* of Bowyer, by Nichols.

he requested a single day to consider the matter, and then replied that he had no doubt but he could. Upon this answer, Mr Bowyer, Mr Bettenham and Mr Watts had such a confidence in his abilities, that they lent him 500l. to begin the undertaking, and he applied himself to it with equal assiduity and success. In 1720, the society for promoting Christian knowledge, in consequence of a representation from Mr Solomon Negri, a native of Damascus in Syria, who was well skilled in the Oriental tongues, and had been professor of Arabic in places of note, deemed it expedient to print, for the use of the Eastern churches, the New Testament and Psalter in the Arabic language. These were intended for the benefit of the poor Christians in Palestine, Syria, Mesopotamia, Arabia, and Egypt, the constitution of which countries did not permit the exercise of the art of printing. Upon this occasion Mr Caslon was pitched upon to cut the fount; in his specimens of which he distinguished it by the name of English Arabic. Under the farther encouragement of Mr Bowyer, Mr Bettenham, and Mr Watts, he proceeded with vigour in his employment; and he arrived at length to such perfection, that he not only freed England from the necessity of importing types from Holland, but in the beauty and elegance of those made by him he so far exceeded the productions of the best artificers, that his workmanship was frequently exported to the Continent. In short, his foundery became, in process of time, the most capital one that existed in that or in any other country. Having acquired opulence in the course of his employment, he was put into the commission of the peace for the county of Middlesex. Towards the latter end of his life, his eldest son being in partnership with him, he retired in a great measure from the active execution of business. His death happened in January 1766.

CASPIAN SEA, a large lake of salt water in Asia, bounded by the province of Astrakan on the north, and by part of Persia on the south, east, and west. It is upwards of 400 miles long from south to north, and 300 broad from east to west. This sea forms several gulfs, and embraces between Astrakan and Astrabad an incredible number of small islands. Its bottom is mud, but sometimes mixed with shells. At the distance of some German miles from land it is 500 fathoms deep; but on approaching the shore it is every where so shallow, that the smallest vessels, if loaded, are obliged to remain at a distance.

When we consider that the Caspian is inclosed on all sides by land, and that its banks are in the neighbourhood of very high mountains, we easily see why the navigation in it should be perfectly different from that in every other sea. There are certain winds that domineer over it with such absolute sway, that vessels are often deprived of every resource; and in the whole extent of it there is not a port that can truly be called safe. The north, north-east, and east winds, blow most frequently, and occasion the most violent tempests. Along the eastern shore the east winds prevail; for which reason vessels bound from Persia to Astrakan always direct their course along this shore.

Although the extent of the Caspian Sea is immense, the variety of its productions is exceedingly small. This undoubtedly proceeds from its want of communication with the ocean, which cannot impart to it any portion of its inexhaustible stores. But the animals which this lake nourishes multiply to such a degree, that the Russians, who alone are in condition to make them turn to account, justly consider them as a never failing source of profit and wealth. It will be understood that we speak of the fish of the Caspian and of its fisheries, which make the sole occupation and principal trade of the people inhabiting the banks of the Wolga and of the Jaïk. This business is distinguished into the great and lesser fisheries. The fish compehended under the first division, such as the sturgeon and others, abound in all parts of the Caspian as well as in the rivers that communicate with it, and which they ascend at spawning-time. The small fishes, such as the salmon and many others, observe the general law of quitting the salt waters for the fresh, nor is there an instance of one of them remaining constantly in the sea.

Seals are the only quadrupeds that inhabit the Caspian; but they are there in such numbers as to afford the means of subsistence to many people in that country as well as in Greenland. The varieties of the species are numerous, diversified, however, only by the colour. Some are quite black, others quite white; there are some whitish, some yellowish, some of a mouse-colour, and some streaked like a tiger. They crawl by means of their fore-feet upon the islands, where they became the prey of the fishermen, who kill them with long clubs. As soon as one is dispatched, he is succeeded by several who come to the assistance of their unhappy companion, but come only to share his fate. They are exceedingly tenacious of life, and endure more than thirty hard blows before they die. They will even live for several days after having received many mortal wounds. They are most terrified by fire and smoke; and as soon as they perceive them, retreat with the utmost expedition to the sea. These animals grow so very fat, that they look rather like oil-bags than animals. At Astrakan is made a sort of grey soap with their fat mixed with pot-ashes, which is much valued for its property of cleansing and taking grease from woollen stuffs. The greatest numbers of them are killed in spring and autumn. Many small vessels go from Astrakan merely to catch seals.

If the Caspian has few quadrupeds, it has in proportion still fewer of those natural productions which are looked upon as proper only to the sea. There have never been found in it any zoophytes, nor any animal of the order of molusca. The same may almost be said of shells; the only ones found being three or four species of cockle, the common muscle, some species of snails, and one or two others.

But to compensate this sterility, it abounds in birds of different kinds. Of those that frequent the shores there are many species of the goose and duck kind, of the stork and heron, and many others of the wader tribe. Of birds properly aquatic, it contains the grebe, the crested diver, the pelican, the cormorant, and almost every species of gull. Crows are so fond of fish, that they haunt the shores of the Caspian in prodigious multitudes.

The waters of this lake are very impure, the great numbers of rivers that run into it, and the nature of its bottom, affecting it greatly. It is true, that in general the waters are salt; but though the whole western shore extends

extends from the 46th to the 35th degree of north latitude, and though one might conclude from analogy that these waters would contain a great deal of salt, yet experiments prove the contrary: and it is certain that the saltness of this sea is diminished by the north, north-east, and north-west winds; although we may with equal reason conclude, that it owes its saltness to the mines of salt which lie along its two banks, and which are either already known or will be known to posterity. The depth of these waters also diminishes gradually as you approach the shores, and their saltness in the same way grows less in proportion to their proximity to the land, the north winds not unfrequently causing the rivers to discharge into it vast quantities of troubled water impregnated with clay. These variations which the sea is exposed to are more or less considerable according to the nature of the winds; they affect the colour of the river waters to a certain distance from the shore, till these mixing with those of the sea, which then resume the ascendency, the fine green colour appears, which is natural to the ocean, and to all those bodies of water that communicate with it.

It is well known, that besides its salt taste, all sea-water has a sensible bitterness, which must be attributed not only to the salt itself, but to the mixture of different substances that unite with it, particularly to different sorts of alum, the ordinary effect of different combinations of acids. Besides this, the waters of the Caspian have another taste, bitter too, but quite distinct, which affects the tongue with an impression similar to that made by the bile of animals; a property which is peculiar to this sea, though not equally sensible at all seasons. When the north and north-west winds have raged for a considerable time, this bitter taste is sensibly felt; but when the wind has been south, very imperfectly. We shall endeavour to account for this phenomenon.

The Caspian is surrounded on its western side by the mountains of Caucasus, which extend from Derbent to the Black Sea. These mountains make a curve near Astrakan, and directing their course towards the eastern shore of the Caspian, lose themselves near the mouth of the Jaïk, where they become secondary mountains, being disposed in strata. As Caucasus is an inexhaustible magazine of combustible substances, it consequently lodges an astonishing quantity of metals in its bowels. Accordingly, along the foot of this immense chain of mountains, we sometimes meet with warm springs, sometimes springs of naphtha of different quality; sometimes we find native sulphur, mines of vitriol, or lakes heated by internal fires. Now the foot of mount Caucasus forming the immediate western shore of the Caspian Sea, it is very easy to imagine that a great quantity of the constituent parts of the former must be communicated to the latter: but it is chiefly to the naphtha, which abounds so much in the countries which surround this sea, that we must attribute the true cause of the bitterness peculiar to its waters; for it is certain that this bitumen flows from the mountains, sometimes in all its purity, and sometimes mixed with other substances which it acquires in its passage through subterranean channels, from the most interior parts of these mountains to the sea, where it falls to the bottom by its specific gravity. It is certain too, that the north and north-west winds detach the greatest quantities of this naphtha; whence it is evident that the bitter taste must be most sensible when these winds prevail. We may also comprehend why this taste is not so strong at the surface or in the neighbourhood of the shore, the waters there being less impregnated with salt, and the naphtha which is united with the water by the salt, being then either carried to a distance by the winds or precipitated to the bottom.



But it is not a bitter taste alone that the naphtha communicates to the waters of the Caspian: these waters were analysed by M. Gmelian, and found to contain, besides the common sea-salt, a considerable proportion of Glauber-salt, intimately united with the former, and which is evidently a production of the naphtha.

As the waters of the Caspian have no outlet, they are discharged by subterranean canals through the earth, where they deposit beds of salt; the surface of which corresponds with that of the level of the sea. The two great desarts which extend from it to the east and west are chiefly composed of a saline earth, in which the salt is formed by efflorescence into regular crystals; for which reason salt showers and dews are exceedingly common in that neighbourhood. The salt of the marshes at Astrakan, and that found in efflorescence in the desarts, is by no means pure sea-salt, but much debased by the bitter Glauber salt we mentioned above. In many places indeed it is found with crystals of a lozenge shape, which is peculiar to it, without any cubical appearance, the form peculiar to crystals of sea-salt.

A great deal has been written on the successive augmentation and decrease of the Caspian sea, but with little truth. There is indeed to be perceived in it a certain rise and fall of its waters; in which, however, no observation has ever discovered any regularity.

Many suppose (and there are strong presumptions in favour of the supposition), that the shores of the Caspian were much more extensive in ancient times than they are at present, and that it once communicated with the Black Sea. It is probable too, that the level of this last sea was once much higher than it is at present. If then it be allowed, that the waters of the Black Sea, before it procured an exit by the Straits of Constantinople, rose several fathoms above their present level, which from many concurring circumstances may easily be admitted; it will follow, that all the plains, of the Crimea, of the Kuman, of the Wolga, and of the Jaïk, and those of Great Tartary beyond the lake of Aral, in ancient times formed but one sea, which embraced the northern extremity of Caucasus by a narrow strait of little depth; the vestiges of which are still obvious in the river Mantysch.

CASSADA. See JATROPHA.

CASSANA, (Nicolo) called NICOLETTO, an eminent Italian painter, was born at Venice in 1659, and became a disciple of his father Giovanni Francesco Cassano, a Genoese, who had been taught the art of painting by Bernardino Strozzi. He soon distinguished himself not only by the beauty of his colouring, but by the gracefulness of his figures in historical compositions, as well as in portrait. The most eminent personages solicited him to enrich their cabinets with some of his performances; and were more particularly desirous to obtain their portraits, because in that branch he excelled beyond competition. The Grand Duke of Tuscany, who was an excellent judge of merit in all professions, and as liberal an encourager of it, invited Nicoletto to his court; and he there painted the portraits of that prince and the princess Violante his consort. Those performances procured him uncommon applause, as well as a noble gratuity, and he was employed and caressed by the principal nobility of Florence. Besides several historical subjects painted by this master while he resided in that city, one was a very capital design: The subject of it was the *Conspiracy of Catiline;* it consisted of nine figures as large as life, down to the knees; and the two principal figures were represented as with one hand joined in the presence of their companions, and in their other hand holding a cup of blood. Some of the English nobility on their travels sat to him for their portraits; which being sent to London, and highly admired, Nicoletto was invited to England, with strong assurances of a generous reception; and on his arrival he experienced the kindness, the respect, and the liberality, so peculiar to the natives of that kingdom. He had the honour of being introduced to the presence of queen Anne, and to paint her portrait; in which he succeeded so happily, that the queen distinguished him by many marks of favour and honour; but he had not the happiness to enjoy his good fortune for any length of time, dying in London, universally regretted, in the year 1713.

CASSANA, (Giovanni Agostino) called *L'Abate Cassana*, was brother to the preceding, and born in 1664. He was educated along with him by their father Francesco Cassana; and he finished his studies at Venice, where his brother Nicolo resided for some time. Although he composed and designed historical subjects with expertness, and with a correctness of outline equal to his brother; yet from prudence and fraternal affection, he declined to interfere with him, and chose therefore to design and paint all sorts of animals and fruits. In that style he arrived at a high degree of excellence, imitating nature with exactness, beauty, and truth; expressing the various plumage of his birds, and the hairs of the different animals with such tenderness and delicacy as rendered them estimable to all judges and lovers of the art. His works were admitted into the collections of those of the first rank, and accounted ornaments of those repositories of what is curious or valuable. He also painted fruits of those kinds which were the most uncommon, or naturally of odd and singular colours; and such fishes as seemed worthy to excite admiration by their unusual form, colour, or appearance. But besides those subjects, he sometimes painted the portraits of particular persons of distinction, which he designed, coloured, and touched, with the same degree of merit that was visible in all his other performances. At last he determined to visit Genoa, where his family had lived in esteem; and took with him several pictures which he had already finished. His intention was to display his generosity, and to appear as a person of more wealth and of greater consequence than he really was; and to support that character, he bestowed his pictures to several of the principal nobility of that city. But, unhappily, he experienced no grateful return for all that prodigal munificence: he reduced himself by that vain liberality to the most necessitous circumstances; was deprived of the means to procure for himself even the common necessaries of life; and wasted away the remainder of his days in the bitterness of poverty, misery, and neglect.



CASSANDER, king of Macedon after Alexander the Great, was the son of Antipater. He made several conquests in Greece, abolished democracy at Athens, and gave the government of that state to the orator Demetrius. Olympias, the mother of Alexander, having caused Aridæus and his wife Euridyce, with others of Cassander's party, to be put to death; he besieged Pydne, whither the queen had retired, took it by a stratagem, and caused her to be put to death. He married Thessalonica the sister of Alexander the Great; and killed Roxana and Alexander, the wife and son of that conqueror. At length he entered into an alliance with Seleucus and Lysimachus, against Antigonus and Demetrius; over whom he obtained a great victory near Ipsus in Phrygia, 301 years before the Christian æra, and died three years after, in the 19th year of his reign.

CASSANDRA, in fabulous history, the daughter of Priam and Hecuba, was beloved of Apollo, who promised to bestow on her the spirit of prophecy, provided she would consent to his love. Cassandra seemed to accept the proposal; but had no sooner obtained that gift, than she laughed at the tempter, and broke her word. Apollo, being enraged, revenged himself by causing no credit to be given to her predictions; hence she in vain prophesied the ruin of Troy. Ajax, the son of Oileus, having ravished her in the temple of Minerva, he was struck with thunder. She fell into the hands of Agamemnon, who loved her to distraction; but in vain did she predict that he would be assassinated in his own country. He was killed, with her, by the intrigues of Clytemnestra; but their death was avenged by Orestes.

CASSANO, a town of Italy in the duchy of Milan, rendered remarkable by an obstinate battle fought there between the Germans and French in 1705. It is subject to the House of Austria, and is seated on the river Adda. in E. Long. 10. 0. N. Lat. 45. 20.

CASSANO, a town of Italy in Calabria citerior, in the kingdom of Naples, with a bishop's see. E. Long. 16. 20. N. Lat. 39. 55.

CASSAVI, or CASSADA. See JATROPHA.

CASSEL, a town of French Flanders, and capital of a chatellany of the same name: It is seated on a mountain, where the terrace of the castle is still to be seen; and from whence there is one of the finest prospects in the world; for one may see no less than 32 towns, with a great extent of the sea, from whence it is distant 15 miles. E. Long. 2. 27. N. Lat. 50. 48.

CASSEL, the capital city of the landgravate of Hesse-cassel, in the circle of the Upper Rhine in Germany; (see HESSE-CASSEL). It is divided into the Old, New, and High towns. The New Town is best built, the houses being of stone, and the streets broad. The houses of the Old Town, which is within the walls, are mostly of timber; but the streets are broad, and the market-places spacious. The place is strongly fortified, but the fortifications are not regular. It contains about 32,000 inhabitants, of whom a great proportion are French Protestants. These have establish-

Cassia. ed several manufactories in the place, particularly in the woollen branch. It is seated on the declivity of a hill near the rivet Fulva, in E. Long. 9. 20. N. Lat. 51. 20.

CASSIA, in botany: A genus of the monogynia order, belonging to the decandria class of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The calyx is pentaphyllous: petals five; antheræ upper, three barren; lower, three-beaked: a leguminous plant. There are 30 species, all of them natives of warm climates. The most remarkable are,

1. The fistula or purging cassia of Alexandria. It is a native of Egypt and both Indies, where it rises to the height of 40 or 50 feet, with a large trunk, dividing into many branches, garnished with winged leaves, composed of five pair of spear-shaped lobes, which are smooth, having many transverse nerves from the midrib to the border. The flowers are produced in long spikes at the end of the branches, each standing upon a pretty long foot-stalk; these are composed, like the former, of fine yellow concave petals, which are succeeded by cylindrical pods from one to two feet long, with a dark brown woody shell, having a longitudinal seam on one side, divided into many cells by transverse partitions, each containing one or two oval, smooth, compressed seeds, lodged in a blackish pulp, which is used in medicine. There are two sorts of this drug in the shops; one brought from the East-Indies, the other from the West: the canes or pods of the latter are generally large, rough, thick-rinded, and the pulp nauseous; those of the former are less, smoother, the pulp blacker, and of a sweeter taste; this sort is preferred to the other. Such pods should be choosen as are weighty, new, and do not make a rattling noise (from the seeds being loose within them) when shaken. The pulp should be of a bright shining black colour, and a sweet taste, not harsh, which happens from the fruit being gathered before it has grown fully ripe, or sourish, which it is apt to turn upon keeping: it should neither be very dry nor very moist, nor at all mouldy; which, from its being kept in damp cellars or moistened, in order to increase its weight, it is very subject to be. Greatest part of the pulp dissolves both in water and in rectified spirit; and may be extracted from the cane by either. The shops employ water, boiling the bruised pod therein, and afterwards evaporating the solution to a due consistence. This pulp is a gentle laxative medicine, and frequently given in a dose of some drams, in costive habits. Some direct a dose of two ounces or more as a cathartic, in inflammatory cases, where the more acrid purgatives have no place; but in these large quantities it generally nauseates the stomach, produces flatulencies, and sometimes gripings of the bowels, especially if the cassia be not of a very good kind: these effects may be prevented by the addition of aromatics, and exhibiting it in a liquid form. Geoffroy says, it does excellent service in the painful tension of the belly, which sometimes follows the imprudent use of antimonials; and that it may be advantageously acuated with the more acrid purgatives, or antimonial emetics, or employed to abate their force. Vallisnieri relates that the purgative virtue of this medicine is remarkably promoted by manna; that a mixture of four drams of cassia, and two of manna, purges as much as twelve drams of cassia or thirty-two of manna alone. Sennertus observes, that the urine is apt to be turned of a green colour by the use of cassia: and sometimes, where a large quantity has been taken, blackish. This drug gives name to an officinal electuary, and is an ingredient also in another.

Cassia Cassida.

2. The cassia senna is a shrubby plant cultivated in Persia, Syria, and Arabia, for the leaves, which form a considerable article of commerce. They are of an oblong figure, sharp-pointed at the ends, about a quarter of an inch broad, and not a full inch in length, of a lively yellowish green colour, a faint not very disagreeable smell, and a subacrid, bitterish, nauseous taste. They are brought from the above places, dried and picked from the stalks, to Alexandria in Egypt, and thence imported into Europe. Some inferior sorts are brought from Tripoli and other places; these may easily be distinguished by their being either narrower, longer, and sharper pointed; or larger, broader, and round pointed, with small prominent veins; or large and obtuse, of a fresh green colour, without any yellow cast. Senna is a very useful cathartic, operating mildly, and yet effectually; and, if judiciously dosed and managed, rarely occasioning the ill consequences which too frequently follow the exhibition of the stronger purges. The only inconveniences complained of in this drug are, its being apt to gripe, and its nauseous flavour. The griping quality depends upon a resinous substance, which, like the other bodies of this class, is naturally disposed to adhere to the coats of the intestines. The more this resin is divided by such matters as take off its tenacity, the less adhesive, and consequently the less irritating and griping it will prove; and the less it is divided, the more griping: hence senna given by itself, or infusions made in a very small quantity of fluid, gripe severely, and purge less than when diluted by a large portion of suitable menstruum, or divided by mixing the infusion with oily emulsions. The ill flavour of this drug is said to be abated by the greater water-figwort: but we cannot conceive that this plant, whose smell is manifestly fetid and its taste nauseous and bitter, can at all improve those of senna: others recommend bohea tea, though neither has this any considerable effect. The smell of senna resides in its most volatile parts, and may be discharged by lightly boiling infusions of it made in water: the liquor thus freed from the peculiar flavour of the senna, may be easily rendered grateful to the taste, by the addition of any proper aromatic tincture or distilled water. The colleges both of London and Edinburgh have given several formulæ for the exhibition of this article, such as those of infusion, powder, tincture, and electuary. The dose of senna in substance, is from a scruple to a dram: in infusion, from one to three or four drams. It has been customary to reject the pedicles of the leaves of senna as of little or no use: Geoffroy however observes, that they are not much inferior in efficacy to the leaves themselves. The pods or seed vessels met with among the senna brought to us, are by the college of Brussels preferred to the leaves: they are less apt to gripe, but proportionably less purgative.

*Cassia-Lignea*. See Laurus.

CASSIDA, in botany. Scutelaria.

Cassida, in zoology, a genus of insects belonging to

Plate CXVI.

to the order of coleoptera. The feelers are like threads, but thicker on the outside; the elytra are marginated; and the head is hid under the thorax; from which last circumstance is derived the name of the genus. Foreign countries afford many fine species of them. Those we meet with in these parts have something singular. Their larva, by the help of the two prongs which are to be found at its hinder extremity, makes itself, with it own excrements, a kind of umbrella, that shelters it from the sun and rain. When this umbrella grows over-dry, it parts with it for a new one. This larva casts its slough several times. Thistles and verticilated plants are inhabited by these insects. There is one species, of which the remarkable chrysalis resembles an armorial escutcheon. It is that which produces our variegated cassida, and is a very singular one. Numbers of them are found on the side of ponds, upon the wild elecampane.

CASSIMER, or CASIMER, the name of a thin tweeled woollen cloth, much in fashion for summer use.

CASSIMIRE or CASHMIRE. See CASHMIRE.

CASSINE, in botany: A genus of the trigynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 23d order, *Dumosæ*. The calyx is quinquepartite; the petals are five; and the fruit is a trispermous berry. There are three species, all of them natives of warm climates.

Of these the most remarkable is the *yapon*, which is a native of the maritime parts of Virginia and Carolina. It rises to the height of ten or twelve feet, sending out branches from the ground upward, garnished with spear shaped leaves placed alternately, which continue green through the year. The flowers are produced in close whorls round the branches, at the footstalks of the leaves; they are white, and divided into five parts, almost to the bottom. The berries are of a beautiful red colour, and as they continue most part of the winter upon the plants without being touched by the birds, we may reasonably conclude that they are possessed of a poisonous quality; as few of the wholesome innocent fruits escape their depredations. The Indians, however, have a great veneration for this plant, and at certains seasons of the year come in great numbers to fetch away the leaves. On such occasions their usual custom, says Miller, is to make a fire upon the ground, and, putting on it a great kettle full of water, they throw in a large quantity of yapon leaves; and when the water has boiled sufficiently, they drink large draughts of the decoction out of the kettle; which seldom fails to vomit them very severely. In this manner, however, they continue drinking and vomiting for three days together, until they imagine themselves sufficiently cleansed; they then gather every one a bundle of the shrub, and carry it home with them.—In the operation of these leaves by vomiting, those who have tasted of them say, that there is no uneasy sensation or pain. The matter discharged comes away in a full stream by the mouth, without any violence, or so much as disposing the patient to reach, or decline his head. The Spaniards who live near the gold mines of Peru, are frequently obliged to drink an infusion of this herb in order to moisten their breasts; without which they are liable to a sort of suffocation, from the strong metallic exhalations that are continually proceeding from the mines. In Paraguay, the Jesuits make a great revenue by importing the leaves of this plant into many countries under the name of Paraguay or South-sea tea, which is there drank in the same manner as that of China or Japan is with us. It is with difficulty preserved in England.



CASSINI, (Johannes Dominicus) a most excellent astronomer, born at Piedmont, in 1635. His early proficiency in astronomy procured him an invitation to be mathematical professor at Bologna when he was no more than 15 years of age: and a comet appearing in 1652, he discovered that comets were not accidental meteors, but of the same nature, and probably governed by the same laws, as the planets. In the same year he solved a problem given up by Kepler and Bullialdus as insolvable, which was, to determine geometrically the apogee and eccentricity of a planet from its true and mean place. In 1663, he was appointed inspector-general of the fortifications of the castle of Urbino, and had afterwards the care of all the rivers in the ecclesiastical state: he still however prosecuted his astronomical studies, by discovering the revolution of Mars round his own axis; and, in 1666, published his theory of Jupiter's satellites. Cassini was invited into France by Louis XIV. in 1669, where he settled as the first professor in the royal observatory. In 1677 he demonstrated the line of Jupiter's diurnal rotation; and in 1684 discovered four more satellites belonging to Saturn, Huygens having found one before. He inhabited the royal observatory at Paris more than forty years; and when he died in 1712, was succeeded by his only son James Cassini.

CASSIODORUS, (Marcus Aurelius) secretary of state to Theodoric king of the Goths, was born at Squillace, in the kingdom of Naples, about the year 470. He was consul in 514, and was in great credit under the reigns of Athalaric and Vitiges; but at seventy years of age retired into a monastery in Calabria, where he amused himself in making sun-dials, water hourglasses, and perpetual lamps. He also formed a library; and composed several works, the best edition of which is that of father Garret, printed at Rouen in 1679. Those most esteemed are his Divine Institutions, and his Treatise on the Soul. He died about the year 562.

CASSIOPEIA, in fabulous history, wife to Cepheus king of Æthiopia, and mother of Andromeda. She thought herself more beautiful than the Nereides, who desired Neptune to revenge the affront; so that he sent a sea-monster into the country, which did much harm. To appease the god, her daughter Andromeda was exposed to the monster, but was rescued by Perseus; who obtained of Jupiter, that Cassiopeia might be placed after his death among the stars: hence the constellation of that name.

CASSIOPEIA, in astronomy, one of the constellations of the northern hemisphere, situated next to Cepheus. In 1672, there appeared a new star in this constellation, which first surpassed in magnitude and brightness Jupiter himself; but it diminished by degrees, and at last disappeared at the end of eighteen months. It alarmed all the astronomers of that age, many of whom wrote dissertations on it; among the rest Tycho Brahe, Kepler, Maurolycus, Lycetus, Gramineus, &c. Beza, the landgrave of Hesse, Rosa, &c. wrote to prove it a comet, and the same which appeared to the Magi at the

the birth of Jesus Christ, and that it came to declare his second coming: they were answered on this subject by Tycho. The stars in the constellation Cassiopeia, in Ptolemy's catalogue, are thirteen: in Hevelius's, thirty-seven; in Tycho's, forty-six; but in the Britannic catalogue, Mr Flamstead makes them fifty-five.

CASSIS, in antiquity, a plated or metalline helmet; different from the *galea*, which was of leather.

CASSITERIA, in the history of fossils, a genus of crystals, the figures of which are influenced by an admixture of some particles of tin.

The cassiteria are of two kinds; the whitish pellucid cassiterion, and the brown cassiterion. The first is a tolerable bright and pellucid crystal, and seldom subject to the common blemishes of crystal: it is of a perfect and regular form, in the figure of a quadrilateral pyramid; and is found in Devonshire and Cornwall principally. The brown cassiterion is like the former in figure: it is of a very smooth and glossy surface, and is also found in great plenty in Devonshire and Cornwall.

CASSITERIDES, (anc. geog.) a cluster of islands to the west of the Land's End; opposite to Celtiberia, (Pliny); famous for their tin, which he calls *candidum plumbum*; formerly open to none but the Phoenicians; who alone carried on this commerce from Gades, concealing the navigation from the rest of the world, (Strabo.) The appellation is from *Cassiteros*, the name for tin in Greek. Now thought to be the Scilly Islands, or Sorlings, (Camden).

CASSIUS, (Spurius) a renowned Roman general and consul, whose enemies accusing him of aspiring to royalty, he was thrown down from the Tarpeian rock, 485 years before Christ; after having thrice enjoyed the consular dignity, been once general of the horse under the first dictator that was created at Rome, and twice received the honour of a triumph.

Cassius, (Longinus) a celebrated Roman lawyer, flourished 113 years before Christ. He was so inflexible a judge, that his tribunal was called the *Rock of the impeached*. It is from the judicial severity of this Cassius, that very severe judges have been called *Cassiani*.

Cassius, (Caius) one of the murderers of Julius Cæsar: after his defeat by Mark Anthony at the battle of Philippi, he ordered one of his freed-men to put him to death with his own sword, 41 years before Christ. See Rome.

CASSOCK, or Cassula, a kind of robe or gown, wore over the rest of the habit, particularly by the clergy. The word cassock comes from the French *casaque*, an horseman's coat.

CASSONADE, in commerce, cask sugar, or sugar put into casks or chests, after the first purification, but which has not been refined. It is sold either in powder or in lumps; the whitest, and that of which the lumps are largest, is the best. Many imagine it to sweeten more than loaf sugar; but it is certain that it yields a great deal more scum.

CASSOWARY, in ornithology. See Struthio.

CASSUMAR, in the Materia Medica, a root approaching to that of zedoary.

It is cardiac and sudorific, and famous in nervous cases; it is also an ingredient in many compositions, and is prescribed in powders, boluses, and infusions. Its dose is from five to fifteen grains.



CASSUMBAZAR, a town of India, in Asia, situated on the river Ganges, in the province of Bengal. E. Long. 87. and N. Lat. 24.

CAST is peculiarly used to denote a figure or small statue of bronze. See Bronze.

Cast, among the founders, is applied to tubes of wax fitted in divers parts of a mould of the same matter; by means of which, when the wax of the mould is removed, the melted metal is conveyed into all the parts which the wax before possessed.

Cast, also denotes a cylindrical piece of brass or copper, slit in two, lengthwise, used by the founders in sand, to form a canal or conduit in their moulds, whereby the metal may be conveyed to the different pieces intended to be cast.

Cast, among plumbers, denotes a little brazen funnel at one end of a mould, for casting pipes without soldering, by means of which the melted metal is poured into the mould.

Cast, or *Caste*, in speaking of the eastern affairs, denotes a tribe, or number of families, of the same rank and profession. The division of a nation into casts chiefly obtains in the dominions of the Great Mogul, kingdom of Bengal, island of Ceylon, and the great peninsula opposite thereto. In each of these there are, according to father Martin, four principal casts, *viz.* the cast of the *bramins*, which is the first and most noble; the cast of the *rajas*, or princes, who pretend to be descended from divers royal families; the cast of the *choutres*, which comprehends all the artificers; and that of the *parias*, the lowest and most contemptible of all: though Henry Lord, it must be observed, divides the Indians about Surat into four *casts*, somewhat differently from Martin, *viz.* into *bramins*, or priests; *cuttery*, or soldiers; *shuddery*, which we call banians, or merchants; and *wyse*, the mechanics or artificers. Every art and trade is confined to its proper *cast*, nor is allowed to be exercised by any but those whose fathers professed the same. So that a taylor's son can never rise to be a painter, nor a painter's son fall to be a taylor; though there are some employments that are proper to all the casts, *e.g.* every body may be a soldier, or a merchant. There are also divers casts which are allowed to till the ground, but not all. The cast of *parias* is held infamous, in so much that it is a disgrace to have any dealings or conversation with them; and there are some trades in the cast of *choutres*, which debase their professors almost to the same rank. Thus shoemakers, and all artificers in leather, as also fishermen, and even shepherds, are reputed no better than *parias*.

CASTAGNO, (Andrea Dal) historical painter, was born at a small village called Castagno, belonging to the territory of Tuscany, in 1409; and being deprived of his parents, was employed by his uncle to attend the herds of cattle in the fields; but, having accidentally seen an ordinary painter at work in the country, he observed him for some time with surprise and attention, and afterwards made such efforts to imitate him, as astonished all who saw his productions. The extraordinary genius of Andrea, became at last a common topic of discourse in Florence; and so far excited the curiosity of Bernardetto de Medici, that he sent for Andrea; and perceiving that he had promising talents, he placed him under the care of the best

best masters who were at that time in Florence. Andrea diligently pursued his studies, devoted himself entirely to practice under the direction of his instructors, became particularly eminent in design, and in a few years made so great a progress, that he found as much employment as he could possibly execute. He painted only in distemper, and fresco, with a manner of colouring that was not very agreeable, being rather dry and hard; till he learned the secret of painting in oil from Domenico Venetiano, who had derived his knowledge of that new discovery from Antonello da Messina. Andrea was the first of the Florentine artists who painted in oil; but although he was in the highest degree indebted to Domenico for disclosing the secret, yet he secretly envied the merit of the man who taught him the art; and because his own works seemed to be much less admired than those of Domenico, he determined to assassinate his friend and benefactor. He executed his design with the utmost ingratitude and treachery (for Domenico at that time lived with him, and painted in partnership with him), and he stabbed him at a corner of a street so secretly, that he escaped unobserved, and unsuspected, to his own house, where he composedly sat down to work; and thither Domenico was soon after conveyed, to die in the arms of his murderer. The real author of so inhuman a transaction, was never discovered, till Andrea, through remorse of conscience, disclosed it on his death-bed, in 1480. He finished several considerable works at Florence, by which he gained great riches, and as great a reputation; but when his villanous misconduct became public, his memory was ever after held in the utmost detestation. The most noted work of this master is in the hall of justice at Florence, representing the execution of the conspirators against the house of Medici.

CASTALIO, (Sebastian) was born at Chetillon, on the Rhone, in the year 1515. Calvin conceived such an esteem and friendship for him, during the stay he made at Strasburg in 1540 and 1541, that he lodged him some days at his house, and procured him a regent's place in the college of Geneva. Castalio, after continuing in this office near three years, was forced to quit it in the year 1544, on account of some particular opinions which he held concerning Solomon's song, and Christ's descent into hell. He retired to Basil, where he was made Greek professor, and died in that place in 1564, aged 48. He incurred the high displeasure of Calvin and Theodore Beza, for differing with them concerning predestination and the punishment of heretics. His works are very considerable both on account of their quality and number. In 1545, he printed at Basil four books of dialogues, containing the principal histories of the Bible in elegant Latin; so that youth might thereby make a proficiency in piety and in the Latin tongue at the same time. But his principal work is a Latin and French translation of the scriptures. He began the Latin translation at Geneva in 1542, and finished it at Basil in 1550. It was printed at Basil in 1551, and dedicated by the author to Edward VI. king of England. The French version was dedicated to Henry II. of France, and printed at Basil in 1555. The fault which has been most generally condemned in his Latin translation, is the affectation of using only classical terms.



CASTALIUS FONS, (Strabo, Pausanias); *Castalia*, (Pindar, Virgil): A fountain at the foot of mount Parnassus, in Phocis, near the temple of Apollo, or near Delphi; sacred to the Muses, thence called *Castalides*. Its murmurs were thought prophetic, (Nonnus, Lucian).

CASTANEA, in botany. See FAGUS

CASTANETS, CASTAGNETTES, or CASTANETTAS, a kind of musical instrument, wherewith the Moors, Spaniards, and Bohemians, accompany their dances, sarabands, and guittars. It consists of two little round pieces of wood dried, and hollowed in manner of a spoon, the concavities whereof are placed on one another, fastened to the thumb, and beat from time to time with the middle finger, to direct their motion and cadences. The *castanets* may be beat eight or nine times in the space of one measure, or second of a minute.

CASTANOVITZ, a town of Croatia, situated on the river Unna, which divides Christendom from Turkey. E. Long. 17. 20. N. Lat. 45. 40. It is subject to the House of Austria.

CASTEL, (Lewis Betrand), a learned Jesuit, was born at Montpellier in 1688, and entered among the Jesuits in 1703. He studied polite literature in his youth; and at length applied himself entirely to the study of mathematics and natural philosophy. He distinguished himself by writing on gravity; the mathematics; and on the music of colours, a very whimsical idea, which he took great pains to reduce to practice. His piece on gravity, entitled *Traitê de la Pensateur universelle*, was printed at Paris, in 1724. He afterwards published his *Mathematique universelle*; which occasioned his being unanimously chosen a fellow of the Royal Society of London, without the least solicitation. He was also a member of the academies of Bourdeaux and Rouen: but his *Clavecin oculaire* made the most noise; and he spent much time and expence in making an harpsichord for the eye, but without success. He also wrote for and against Sir Isaac Newton, and published several other works; the principal of which are, *Le Plan du Mathematique abregée*, and a treatise entitled *Optique des Colours*. He led a very exemplary life, and died in 1757.

CASTELAMARA, a town of Italy, in the kingdom of Naples, and in the hither Principato, with a bishop's see and a good harbour. E. Long. 14. 25. N. Lat. 41. 40.

CASTEL-ARAGONESE, a strong town of Italy, in the island of Sardinia, with a bishop's see, and a good harbour. It is seated on the N. W. coast of the island, in E. Long. 8. 57. N. Lat. 40. 56.

*CASTEL-Branco*, a town of Portugal, and capital of the province of Beria; seated on the river Lyra, 35 miles N. W. of Alcantara. W. Long. 8. 0. N. Lat. 39. 35.

*CASATEL-Franco*, a very small, but well-fortified frontier town of the Bolognese, in Italy, belonging to the Pope.

*CASTEL-de-Vide*, a small strong town of Alentejo. It was taken by Philip V. W. Long. 6. 25. N. Lat. 39. 15.

*CASTEL-Folit*, a town of Spain, in Catalonia, seated on an inaccessible eminence, between Gironne and Campredon,

Campredon, about 15 miles from each, and near the river Fulvia.

*Castel-Gandolpho*, a town of Italy, in the territory of the church, with a castle, to which the Pope retires in the summer season; 10 miles S. by E. of Rome. E. Long. 12. 46. N. Lat. 41. 44.

*Castel-Novo*, a strong town of Dalmatia, subject to the Venetians; seated on the gulph of Cataio, in E. Long. 18. 45. N. Lat. 42. 25.

*Castel-Rodrigo*, a town of Portugal, in the province of Tra-los-Montes, in W. Long. 7. 1. N. 41. 0.

*Castel-Novo-de-Carfagnana*, a town of Italy, in the Modenese, with a strong fortress. It is the capital of the valley of Carfagnana; and seated on the river Serchio, 17 miles above Lucca.

*Castel del Ovo*, a small island in the Tuscan Sea, in the gulph of Naples, near a town of that name, to which it is joined by a stone bridge. The fortress is called Castel del Ovo, in which there is always a good garrison.

CASTELBAR, a town in Ireland, in the county of Mayo, and province of Connaught, 35 miles N. of Galway. W. Long. 9. 25. N. Lat. 53. 45.

CASTELL, (Edmund) D. D. a learned English divine of the 17th century, distinguished by his skill in the eastern languages. He was educated at Cambridge; where he was master of Catherine hall, and Arabic professor; and was at length canon of Canterbury. He had the greatest share in the Polyglott bible of London; and wrote the *Heptaglotton pro septem Orientalibus, &c.* On this excellent work, which occupied a great part of his life, he bestowed incredible pains and expence, even to the breaking of his constitution, and exhausting of his fortune, having expended no less that 12,000 l. upon that work. At length, when it was printed, the copies remained unsold upon his hands. He died in 1685; and lies buried in the church-yard of Higham Gobyon in Bedfordshire, of which he was rector. It appears from the inscription on his monument, which he erected in his lifetime, that he was chaplain to Charles II. He bequeathed all his oriental manuscripts to the university of Cambridge, on condition that his name should be written on every copy in the collection.

CASTELLA, a town of the Mantuan, in Italy, about five miles north-east of the city of Mantua. E. Long. 11. 15. N. Lat. 45. 30.

CASTELLAN, the name of a dignity or charge in Poland: The castellans are senators of the kingdom, but senators only of the lower class, who, in diets, sit on low seats, behind the palatines, or great senators. They are a kind of lieutenants of provinces, and command a part of the palatinate under the palatine.

CASTELLANY, the territory belonging to any city or town, chiefly used in France and Flanders: Thus we say, the castellany of Lisle, Ypres, &c.

CASTELLARIUS, the keeper or curator, of a castellum. Gruter gives an ancient sepulchral inscription in memory of a *castellarius*.

CASTELLATIO, in middle age writers, the act of building a castle, or fortifying a house, and rendering it a castle.—By the ancient English laws, castellation was prohibited without the king's especial licence.



CASTELLI, (Bernard) an Italian painter, was born at Genoa, in 1557; and excelled in colouring and in portraits. He was the intimate friend of Tasso, and took upon himself the task of designing and etching the figures of his Jerusalem Delivered. He died at Genoa in 1629.

Valerio Castelli, one of his sons, was born at Genoa in 1625, and surpassed his father. He particularly excelled in painting battles; which he composed with spirit, and executed them with so pleasing a variety, and so great freedom of hand, as gained him universal applause. His horses are admirably drawn, thrown into attitudes that are natural and becoming, full of motion, action, and life. In that style of painting he showed all the fire of Tintoretto, united with the fine taste of composition of Paolo Veronese. He died in 1659. The works of this master are not very frequent; but they are deservedly held in very high esteem. It is believed that a greater number of his easel pictures are in the collections of the nobility and gentry of England, than in any other part of Europe.

CASTELLORUM OPERATIO, castle-work, or service and labour done by inferior tenants for the building and upholding of castles of defence; towards which some gave personal assistance, and others paid their contributions. This was one of the three necessary charges to which all lands among the Anglo-Saxons were expresly subject.

CASTELVETRO, (Lewis) a native of Modena, of the 16th century, famous for his *Comment on Aristotle's Poetics*. He was prosecuted by the inquisition for a certain book of Melancthon, which he had translated into Italian. He retired to Basil, where he died.

CASTIGATION, among the Romans, the punishment of an offender by blows, or beating with a wand or switch. Castigation was chiefly a military punishment; the power of inflicting which on the soldiery was given to the tribunes. Some make it of two kinds; one with a stick or cane called *fustigatio*; the other with rods, called *flagellatio*: the latter was the most dishonourable.

CASTIGATORY *for* SCOLDS. A woman indicted for being a common scold, if convicted, shall be placed in a certain engine of correction, called the *trebucket, castigatory*, or *cucking-stool*; which, in the Saxon language, signifies the *scolding-stool*; though now it is frequently corrupted into the *ducking-stool*; because the residue of the judgment is, that, when she is placed therein, she shall be plunged in water for her punishment.

CASTIGLIONE, (Giovanni Benedetto) a celebrated painter, was born at Genoa in 1616. His first master was Gio-Battista Paggi. Afterwards he studied under Andrea Ferrari; and lastly perfected himself from the instructions of Anthony Vandyck, who at that time resided at Genoa. He painted portraits, historical pieces, landscapes, and castles: In the latter of which he is said chiefly to have excelled; as also in fairs, markets, and all kinds of rural scenes. By this master we have also a great number of etchings, which are all spirited, free, and full of taste. The effect is, in general, powerful and pleasing; and many of them have a more harmonized and finished appearance, than is usual from the

the point, so little assisted by the graver. His drawing of the naked figure, though by no means correct, is notwithstanding managed in a style that indicates the hand of the master.

His son, *Francesco*, was bred under himself, and excelled in the same subjects; and it is thought that many good paintings which are ascribed to Benedetto, and are frequently seen at sales, or in modern collections, are copies after him by his son Francesco, or perhaps originals of the younger Castiglione.

CASTIGLIONE, a small, but strong town of Italy, in Mantua, with a castle. It was taken by the Germans in 1701, and the French defeated the Imperialists near it in 1706. E. Long. 10. 29. N. Lat 43. 23.

CASTIGLIONI, (Balthazar) an eminent Italian nobleman, descended from an illustrious and ancient family, and born at his own villa at Casalico in the duchy of Milan in 1478. He studied painting, sculpture, and architecture, as appears from a book he wrote in favour of these arts; and excelled so much in them that Raphael Urbino, and Buonaroti, though incomparable artists, never thought their works complete without the approbation of Count Castiglioni. When he was 26 years of age, Guido Ubaldo, Duke of Urbino, sent him ambassador to Pope Julius II. He was sent upon a second embassy to Louis XII. of France, and upon a third to Henry VII. of England. After he had dispatched his business here, he returned, and began his celebrated work intitled *the Courtier;* which he completed at Rome in 1516. This work is full of moral and political instruction: and if we seek for the Italian tongue in perfection, it is said to be no where better found than in this performance. A version of this work, together with the original Italian, was published at London in 1727, by A. P. Castiglioni, a gentleman of the same family, who resided there under the patronage of Dr Gibson bishop of London. Count Castiglioni was sent by Clement VII. to the court of the Emperor Charles V. in quality of legate, and died at Toledo in 1529.

CASTILE, (NEW) or THE KINGDOM OF TOLEDO, a province of Spain, bounded on the north by Old Castile, on the east by the kingdoms of Arragon and Valencia, on the south by that of Murcia and Andalusia, and on the west by the kingdom of Leon. It is divided into three parts; Argaria to the north, Mancha to the east, and Sierra to the south. Madrid is the capital. Both these provinces are very well watered with rivers, and the air is generally pure and healthy; but the land is mountainous, dry, and uncultivated, through the laziness of the inhabitants. The north part produces fruits and wine, and the south good pastures and fine wool. These provinces are divided by a long chain of mountains, which run from east to west.

*CASTILE, (Old)* a province of Spain, with the title of a kingdom. It is about 192 miles in length, and 115 in breadth; bounded on the south by New Castile, on the east by Arragon and Navarre, on the north by Biscay and Asturia, and on the west by the kingdom of Leon. Burgos is the capital town.

*CASTILE-de-Oro*, a large and fertile country in South America, lying to the west of Oroonoko. It comprehends eight governments; viz. Terra Firma, Proper Carthagena, St Martha, Rio de la Hacha, Venisuela, New Andalusia, Popayan, and the new kingdom of Grenada.

CASTILLAN, or CASTILLANE, a gold coin, current in Spain, and worth fourteen rials and sixteen deniers.

CASTILLAN is also a weight used in Spain for weighing gold. It is the hundredth part of a pound Spanish weight. What they commonly call a weight of gold in Spain, is always understood of the castillan.

CASTILLARA, a town of the Mantuan in Italy, situated six miles north-east of the city of Mantua. E. Long. 11. 25. N. Lat. 45. 20.

CASTILLON, a town of Perigort, in the province of Guienne in France, situated on the river Dordonne, 16 miles east of Bourdeaux. W. Long. 2. 40. N. Lat. 44. 50.

CASTING, in foundery, the running a metal into a mould, prepared for that purpose.

*CASTING of Metals, of Letters, Bells, &c.* See the article FOUNDREY.

*CASTING in Sand or Earth* is the running of metals between two frames, or molds, filled with sand or earth, wherein the figure that the metal is to take has been impressed *en creux*, by means of the pattern.

CASTING, among sculptors, implies the taking of casts and impressions of figures, busts, medals, leaves, &c.

The method of taking of casts of figures and busts is most generally by the use of plaster of Paris, *i. e.* alabaster calcined by a gentle heat. The advantage of using this substance preferably to others, is, that notwithstanding a slight calcination reduces it to a pulverine state, it becomes again a tenacious and cohering body, by being moistened with water, and afterwards suffered to dry; by which means either a concave or a convex figure may be given by a proper mold or model to it when wet, and retained by the hardness it acquires when dry: and from these qualities, it is fitted for the double purpose of making both casts, and molds for forming those casts. The particular manner of making casts depends on the form of the subject to be taken. Where there are no projecting parts, it is very simple and easy; as likewise where there are such as form only a right or any greater angle with the principal surface of the body: but where parts project in lesser angles, or form a curve inclined towards the principal surface of the body, the work is more difficult.

The first step to be taken is the forming the mold. In order to this, if the original or model be a bass relief, or any other piece of a flat form, having its surface first well greased, it must be placed on a proper table, and surrounded by a frame, the sides of which must be at such a distance from it as will allow a proper thickness for the sides of the mold. As much plaster as will be sufficient to cover and rise to such a thickness as may give sufficient strength to the mold, as also to fill the hollow betwixt the frame and the model, must be moistened with water, till it be just of such consistence as will allow it to be poured upon the model. This must be done as soon as possible; or the plaster would concrete or set, so as to become more troublesome in the working, or unfit to be used. The whole must then be suffered to remain in this condition, till the plaster has attained its hardness; and then the frame being taken away, the preparatory cast

Casting.

cast or mold thus formed may be taken off from the subject entire.

Where the model or original subject is of a round or erect form, a different method must be pursued; and the mold must be divided into several pieces: or if the subject consists of detached and projecting parts, it is frequently most expedient to cast such parts separately, and afterwards join them together.

Where the original subject or mold forms a round, or spheroid, or any part of such round or spheroid, more than one half the plaster must be used without any frame to keep it round the model; and must be tempered with water to such a consistence, that it may be wrought with the hand like very soft paste; but though it must not be so fluid as when prepared for flat figured models, it must yet be as moist as is compatible with its cohering sufficiently to hold together: and being thus prepared, it must be put upon the model, and compressed with the hand, or any flat instrument, that the parts of it may adapt themselves in the most perfect manner, to those of the subject, as well as be compact with respect to themselves. When the model is so covered to a convenient thickness, the whole must be left at rest till the plaster be set and firm, so as to bear dividing without falling to pieces, or being liable to be put out of its form by slight violence; and it must then be divided into pieces, in order to its being taken off from the model, by cutting it with a knife with a very thin blade; and being divided, must be cautiously taken off, and kept till dry: but it must be always carefully observed, before the separation of the parts be made, to notch them cross the joints, or lines of the division, at proper distances, that they may with ease and certainty be properly conjoined again; which would be much more precarious and troublesome without such directive marks. The art of properly dividing the molds, in order to make them separate from the model, requires more dexterity and skill than any other thing in the art of casting; and does not admit of rules for the most advantageous conduct of it in every case. Where the subject is of a round or spheroidal form, it is best to divide the mold into three parts, which will then easily come off from the model; and the same will hold good of a cylinder, or any regular curve figure.

The mold being thus formed, and dry, and the parts put together, it must be first greased, and placed in such a position that the hollow may lie upwards, and then filled with plaster mixed with water, in the same proportion and manner as was directed for the casting the mold: and when the cast is perfectly set and dry, it must be taken out of the mold, and repaired where it is necessary; which finishes the operation.

This is all that is required with respect to subjects where the surfaces have the regularity abovementioned: but where they form curves which interfect each other, the conduct of the operation must be varied with respect to the manner of taking the cast of the mold from off the subject or model; and where there are long projecting parts, such as legs or arms, they should be wrought in separate casts. The operator may easily judge from the original subjects, what parts will come off together, and what require to be separated; the principle of the whole consists only in this, that where under-workings, as they are called, occur, that is, wherever a straight line drawn from the basis or insertion of any projection, would be cut or crossed by any part of such projection, such part cannot be taken off without a division; which must be made either in the place where the projection would cross the straight line; or, as that is frequently difficult, the whole projection must be separated from the main body, and divided also lengthwise into two parts: and where there are no projections from the principal surfaces, but the body is so formed as to render the surface a composition of such curves, that a straight line being drawn parallel to the surface of one part would be cut by the outline, in one or more places, of another part, a division of the whole should be made, so as to reduce the parts of it into regular curves, which must then be treated as such.

In larger masses, where there would otherwise be a great thickness of the plaster, a corps or body may be put within the mold, in order to produce a hollow in the cast: which both saves the expence of the plaster, and renders the cast lighter.

This corps may be of wood, where the forming a hollow of a straight figure, or a conical one with the basis outward, will answer the end: but if the cavity require to be round, or of any curve figure, the corps cannot be then drawn while entire; and consequently should be of such matter as may be taken out piecemeal. In this case, the corps is best formed of clay; which must be worked upon wires to give it tenacity, and suspended in the hollow of the mold, by cross wires lying over the mouth; and when the plaster is sufficiently set to bear handling, the clay must be picked out by a proper instrument.

Where it is desired to render the plaster harder, the water with which it is tempered should be mixed with parchment size properly prepared, which will make it very firm and tenacious.

In the same manner, figures, busts, &c. may be cast of lead, or any other metal, in the molds of plaster: only the expence of plaster, and the tediousness of its becoming sufficiently dry, when in a very large mass, to bear the heat of melted metal, render the use of clay, compounded with some other proper materials, preferable where large subjects are in question. The clay, in this case, should be washed over till it be perfectly free from gravel or stones; and then mixed with a third or more of fine sand to prevent its cracking; or, instead of sand, coal-ashes sifted fine may be used. Whether plaster or clay be employed for the casting in metal, it is extremely necessary to have the mold perfectly dry; otherwise the moisture being rarified, will make an explosion that will blow the metal out of the mold, and endanger the operator, or at least crack the mold in such a manner as to frustrate the operation. Where the parts of a mold are larger, or project much, and consequently require a greater tenacity of the matter they are formed of to keep them together, flocks of cloth, prepared like those designed for paper-hangings, or fine cotton plucked or cut till it is very short, should be mixed with the ashes or sand before they are added to the clay to make the composition for the mold. The proportion should be according to the degree of cohesion required: but a small quantity will answer the end, if the other ingredients

Casting. of the compoſition be good, and the parts of the mold properly linked together by means of the wires above directed.

There is a method of taking caſts in metals from ſmall animals, and the parts of vegetables, which may be practiſed for ſome purpoſes with advantage: particularly for the decorating grottoes or rock-work, where nature is imitated. The proper kinds of animals are lizards, ſnakes, frogs, birds, or inſects; the caſts of which, if properly coloured, will be exact repreſentations of the originals.

This is to be performed by the following method. A coffin or proper cheſt for forming the mold being prepared of clay, or four pieces of boards fixed together, the animal or parts of vegetables muſt be ſuſpended in it by a ſtring; and the leaves, tendrils, or other detached parts of the vegetables, or the legs, wings, *&c.* of the animals, properly ſeparated and adjuſted in their right poſition by a ſmall pair of pincers; a due quantity of plaſter of Paris and calcined talc, in equal quantities, with ſome alumen plumoſum, muſt then be tempered with water to the proper conſiſtence for caſting; and the ſubject from whence the caſt is to be taken, as alſo the ſides of the coffin, moiſtened with ſpirit of wine. The coffin or cheſt muſt then be filled with the tempered compoſition of the plaſter and talc, putting at the ſame time a piece of ſtraight ſtick or wood to the principal part of the body of the ſubject, and pieces of thick wire to the extremities of the other parts, in order that they may form, when drawn out after the matter of the mold is properly ſet and firm, a channel for pouring in the melted metal, and vents for the air; which otherwiſe, by the rarefaction it would undergo from the heat of the metal, would blow it out or burſt the mold. In a ſhort time the plaſter and talc will ſet and become hard, when the ſtick and wires may be drawn out, and the frame or coffin in which the mold was caſt taken away; and the mold muſt then be put firſt into a moderate heat, and afterwards, when it is as dry as can be rendered by that degree, removed into a greater; which may be gradually increaſed till the whole be red-hot. The animal, or part of any vegetable, which was included in the mold, will then be burnt to a coal; and may be totally calcined to aſhes, by blowing for ſome time gently into the channel and paſſages made for pouring in the metal, and giving vent to the air, which will, at the ſame time that it deſtroys the remainder of the animal or vegetable matter, blow out the aſhes. The mold muſt then be ſuffered to cool gently; and will be perfect; the deſtruction of the ſubſtance of the animal or vegetable having produced a hollow of a figure correſpondent to it: but it may be nevertheleſs proper to ſhake the mold, and turn it upſide down, as alſo to blow with the bellows into each of the air-vents, in order to free it wholly from any remainder of the aſhes; or, where there may be an opportunity of filling the hollow with quickſilver without expence, it will be found a very effectual method of clearing the cavity, as all duſt, aſhes, or ſmall detached bodies will neceſſarily riſe to the ſurface of the quickſilver, and be poured out with it. The mold being thus prepared, it muſt be heated very hot when uſed, if the caſt be made with copper or braſs: but a leſs degree will ſerve for lead or tin: and the matter being poured in, the mold muſt be gently ſtruck: and then ſuffered to reſt till it be cold: at which time it muſt be carefully taken from the caſt, but without the leaſt force; for ſuch parts of the matter as appear to adhere more ſtrongly, muſt be ſoftened by ſoaking in water, till they be entirely looſened, that none of the more delicate parts of the caſt may be broken off or bent.

Where the alumen plumoſum, or talc, cannot eaſily be procured, the plaſter may be uſed alone; but it is apt to be calcined by the heat uſed in burning the animal or vegetable from whence the caſt is taken, and to become of too incohering and crumbly a texture: or, for cheapneſs, Sturbridge or any other good clay, waſhed over till it be perfectly fine, and mixed with an equal part of ſand, and ſome flocks cut ſmall, may be employed. Pounded pumice ſtone and plaſter of Paris, taken in equal quantities, and mixed with waſhed clay in the ſame proportion, is ſaid to make excellent molds for this and parallel uſes.

Caſts of metals, or ſuch ſmall pieces as are of a ſimilar form, may be made in plaſter by the method directed for baſs relievos.

Indeed there is nothing more required than to form a mold by laying them on a proper board; and having ſurrounded them by a rim made of a piece of a card, or any other paſteboard, to fill the rim with ſoft tempered plaſter of Paris; which mould, when dry, will ſerve for ſeveral caſts. It is nevertheleſs a better method to form the mold of melted ſulphur; which will produce a ſharper impreſſion in the caſt, and be more durable than thoſe made of plaſter.

The caſts are likewiſe frequently made of ſulphur, which being melted muſt be treated exactly in the ſame manner as the plaſter.

For taking caſts from medals, Dr Lewis recommends a mixture of flowers of brimſtone and red lead: equal parts of theſe are to be put over the fire in a laddle, till they ſoften to the conſiſtence of pap; then they are kindled with a piece of paper, and ſtirred for ſome time. The veſſel being afterwards covered cloſe, and continued on the fire, the mixture grows fluid in a few minutes. It is then to be poured on the metal, previouſly oiled and wiped clean. The caſts are very neat; their colour ſometimes a pretty deep black, ſometimes a dark grey: they are very durable; and when ſoiled, may be waſhed clean in ſpirits of wine. *Philoſoph. Commerce of Arts.*

Dr Letſom recommends tin-foil for taking off caſts from medals. The thinneſt kind is to be uſed. It ſhould be laid over the ſubject from which the impreſſion is to be taken, and then rubbed with a bruſh, the point of a ſkewer, or a pin, till it has perfectly received the impreſſion. The tin-foil ſhould now be pared cloſe to the edge of the medal, till it is brought to the ſame circumference: the medal muſt then be reverſed, and the tin-foil will drop off into a chip-box or mold placed ready to receive it. Thus the concave ſide of the foil will be uppermoſt, and upon this plaſter of Paris, prepared in the uſual manner may be poured. When dry, the whole is to be taken out, and the tin-foil ſticking on the plaſter will give a perfect repreſentation of the medal, almoſt equal in beauty to ſilver. If the box or mold is a little larger than the medal, the plaſter running round the tin-foil will give the appearance of a white frame or circular border; *Naturaliſt's Companion.*

border; whence the new made medal will appear more neat and beautiful.

Casts may be made likewise with iron, prepared in the following manner: "Take any iron bar, or piece of a similar form; and having heated it red-hot, hold it over a vessel containing water, and touch it very slightly with a roll of sulphur, which will immediately dissolve it, and make it fall in drops into the water. As much iron as may be wanted being thus dissolved, pour the water out of the vessel; and pick out the drops formed by the melted iron from those of the sulphur, which contain little or no iron, and will be distinguishable from the other by their colour and weight." The iron will, by this means, be rendered so fusible, that it will run with less heat than is required to melt lead; and may be employed for making casts of medals, and many other such purposes, with great convenience and advantage.

Impressions of medals, having the same effect as casts, may be made also of isinglass glue, by the following means. Melt the isinglass, beaten, as when commonly used, in an earthen pipkin, with the addition of as much water as will cover it, stirring it gently till the whole is dissolved: then with a brush of camel's hair, cover the medal, which should be previously well cleansed and warmed, and then laid horizontally on a board or table, greased in the part around the medal. Let them rest afterwards till the glue be properly hardened; and then, with a pin, raise the edge of it; and separate it carefully from the medal: the cast will be thus formed by the glue as hard as horn; and so light, that a thousand will scarcely weigh an ounce. In order to render the relief of the medal more apparent, a small quantity of carmine may be mixed with the melted insinglass; or the medal may be previously coated with leaf-gold by breathing on it, and then laying it on the leaf, which will by that means adhere to it: but the use of leaf-gold is apt to impair a little the sharpness of the impression.

Impressions of medals may be likewise taken in putty; but it should be the true kind made of calx of tin, and drying oil. These may be formed in the molds, previously taken in plaster or sulphur; or molds may be made in its own substance, in the manner directed for those of the plaster. These impressions will be very sharp and hard; but the greatest disadvantage that attends them, is their drying very slowly, and being liable in the mean time to be damaged.

Impressions of prints, or other engravings, may be taken from copper-plates, by cleansing them thoroughly, and pouring plaster upon them: but the effect in this way is not strong enough for the eye; and therefore the following method is preferable, where such impressions on plaster are desired.

Take vermilion, or any other coloured pigment, finely powdered, and rub it over the plate: then pass a folded piece of paper, or the flat part of the hand, over the plate, to take off the colour from the lights or parts where there is no engraving: the proceeding must then be the same as where no colour is used. This last method is also applicable to the making of impressions of copper-plates on paper with dry colours: for the plate being prepared as here directed, and laid on the paper properly moistened, and either passed under the rolling-press, or any other way strongly forced down on the paper, an impression of the engraving will be obtained.

Impressions may be likewise taken from copper-plates, either on plaster or paper, by means of the smoke of a candle or lamp: if, instead of rubbing them with any colour, the plate be held over the candle or lamp till the whole surface become black, and then wiped off by the flat of the hand, or paper.

These methods are not, however, of great use in the case of copper-plates, except where impressions may be desired on occasions where printing-ink cannot be procured: but as they may be applied likewise to the taking impressions from snuff-boxes, or other engraved subjects, by which means designs may be instantly borrowed by artists or curious persons, they may in such instances be very useful.

The expedient of taking impressions by the smoke of a candle or lamp may be employed also for botanical purposes in the case of leaves, as a perfect and durable representation of not only the general figure, but the contexture and disposition of the larger fibres, may be extemporaneously obtained at any time. The same may be nevertheless done in a more perfect manner, by the use of linseed oil, either alone, or mixed with a small proportion of colour, where the oil can be conveniently procured: but the other method is valuable on account of its being practicable at almost all seasons, and in all places, within the time that the leaves will keep fresh and plump. In taking these impressions, it is proper to bruise the leaves, so as to take off the projections of the large ribs, which might prevent the other parts from plying to the paper.

Leaves, as also the petals, or flower-leaves, of plants, may themselves be preserved on paper, with their original appearance, for a considerable length of time, by the following means.—Take a piece of paper, and rub it over with isinglass glue, treated as above directed for taking impressions from medals; and then lay the leaves in a proper position on the paper. The glue laid on the paper being set, brush over the leaves with more of the same; and that being dry likewise, the operation will be finished, and the leaves so secured from the air and moisture, that they will retain their figure and colour much longer than by any other treatment.

Butterflies, or other small animals of a flat figure, may also be preserved in the same manner.

Casting is also sometimes used for the quitting, laying, or throwing aside any thing; thus deer cast their horns, snakes their skins, lobsters their shells, hawks their feathers, *&c.* annually.

*Casting of feathers* is more properly called *moulting* or *mewing*.

A horse *casts* his hair, or coat, at least once a-year, viz. in the spring when he casts his winter coat; and sometimes, at the close of autumn, he casts his summer coat, in case he has been ill kept. Horses also sometimes *cast* their hoofs, which happens frequently to coach-horses brought from Holland: these, being bred in a moist marshy country, have their hoofs too flabby: so that coming into a drier soil, and less juicy proven-

 der,

Casting, Castle.

der, their hoofs fall off, and others that are firmer succeed.

*Casting a Colt*, denotes a mare's proving abortive.

*Casting-Net*, a sort of fishing-net so called, because it is to be *cast*, or thrown out; which when exactly done, nothing escapes it, but weeds and every thing within its extent are brought away.

CASTLE, a fortress, or place rendered defensible either by nature or art. It frequently signifies in Britain the principal mansion of noblemen. In the time of Henry II. there were no less than 1115 castles in England, each of which contained a manor.

Castles, walled with stone, and designed for residence as well as defence, are, for the most part, according to Mr Grose, of no higher antiquity than the conquest: for although the Saxons, Romans, and even, according to some writers on antiquity, the ancient Britons, had castles built with stone; yet these were both few in number, and, at that period, through neglect or invasions, either destroyed, or so much decayed, that little more than their ruins were remaining. This is asserted by many of the historians and antiquaries, and assigned as a reason for the facility with which William made himself master of that country.

*Grose's Antiquities of England and Wales*, Vol. I. Preface.

This circumstance was not overlooked by so good a general as the Conqueror; who, effectually to guard against invasions from without, as well as to awe his newly acquired subjects, immediately began to erect castles all over the kingdom, and likewise to repair and augment the old ones. Besides, as he had parcelled out the lands of the English amongst his followers, they, to protect themselves from the resentment of those so despoiled, built strong holds and castles on their estates. This likewise caused a considerable increase of these fortresses; and the turbulent and unsettled state of the kingdom in the succeeding reigns, served to multiply them prodigiously, every baron or leader of a party building castles; insomuch, that towards the latter end of the reign of king Stephen, they amounted to the almost incredible number of 1115.

As the feudal system gathered strength, these castles became the heads of baronies. Each castle was a manor: and its castelain, owner, or governor, the lord of that manor. Markets and fairs were directed to be held there; not only to prevent frauds in the king's duties or customs, but also as they were esteemed places where the laws of the land were observed, and as such had a very particular privilege. But this good order did not long last: for the lords of castles began to arrogate to themselves a royal power, not only within their castles, but likewise its environs; exercising judicature both civil and criminal, coining of money, and arbitrarily seizing forage and provision for the subsistence of their garrisons, which they afterwards demanded as a right: at length their insolence and oppression grew to such a pitch, that according to William of Newbury, "there were in England as many kings, or rather tyrants, as lords of castles;" and Matthew Paris styles them, very nests of devils and dens of thieves. Castles were not solely in the possession of the crown and the lay barons, but even bishops had these fortresses; though it seems to have been contrary to the canons, from a plea made use of in a general council, in favour of king Stephen, who had seized upon the strong castles of the bishops of Lincoln and Salisbury. This prohibition (if such existed) was however very little regarded; as in the following reigns many strong places were held, and even defended, by the ecclesiastics: neither was more obedience afterwards paid to a decree made by the Pope at Viterbo, the fifth of the kalends of June 1220, wherein it was ordained, that no person in England should keep in his hands more than two of the king's castles.

Castle.

The licentious behaviour of the garrisons of these places becoming intolerable, in the treaty between king Stephen and Henry II. when only duke of Normandy, it was agreed, that all the castles built within a certain period should be demolished; in consequence of which many were actually rased, but not the number stipulated.

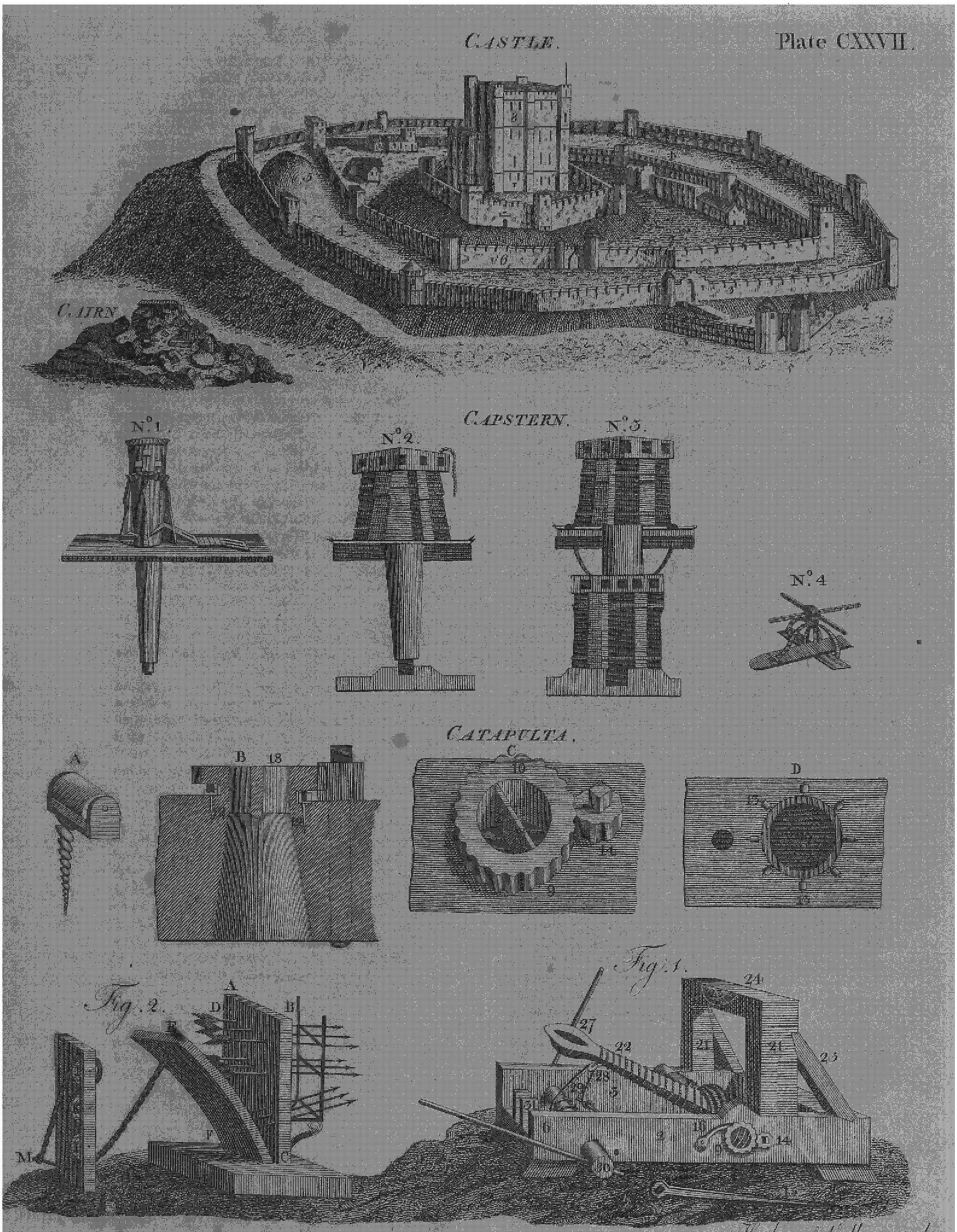
The few castles in being under the Saxon government, were probably, on occasion of war or invasions, garrisoned by the national militia, and at other times slightly guarded by the domestics of the princes or great personages who resided therein; but after the conquest, when all the estates were converted into baronies held by knight's service, castle-guard coming under that denomination, was among the duties to which particular tenants were liable. From these services the bishops and abbots, who till the time of the Normans had held their lands in frank almoign, or free alms, were, by this new regulation, not exempted; they were not indeed, like the laity, obliged to personal service, it being sufficient that they provided fit and able persons to officiate in their stead. This was however at first stoutly opposed by Anselm archbishop of Canterbury; who being obliged to find some knights to attend king William Rufus in his wars in Wales, complained of it as an innovation and infringement of the rights and immunities of the church.

It was no uncommon thing for the Conqueror and the kings of those days, to grant estates to men of approved fidelity and valour, on condition that they should perform castle-guard in the royal castles, with a certain number of men, for some specified time; and sometimes they were likewise bound by their tenures to keep in repair and guard some particular tower or bulwark, as was the case at Dover castle.

In process of time these services were commuted for annual rents, sometimes styled *ward-penny*, and waytfee, but commonly *castle-guard* rents, payable on fixed days, under prodigious penalties called *sursizes*. At Rochester, if a man failed in the payment of his rent of castle-guard on the feast of St Andrew, his debt was doubled every tide during the time for which the payment was delayed. These were afterwards restrained by an act of parliament made in the reign of king Henry VIII. and finally annihilated, with the tenures by knight's service, in the time of Charles II. Such castles as were private property were guarded either by mercenary soldiers, or the tenants of the lord or owner.

Castles which belonged to the crown, or fell to it either by forfeiture or escheat (circumstances that frequently happened in the distracted reigns of the feudal times), were generally committed to the custody of some trusty person, who seems to have been indifferently styled governor and constable. Sometimes also they were put into the possession of the sheriff of the county, who

often


CASTLE.
Plate CXXVII.
CAIRN.
CAPSTERN.
N.° 1.
N.° 2.
N.° 3.
N.° 4
CATAPULTA.
A
B 18
C
D
Fig. 1.
Fig. 2.
Thackara & Vallance sculp.

Caftle. often converted them to prifons. That officer was then accountable at the exchequer, for the farm or produce of the lands belonging to the places entrufted to his care, as well as all other profits: he was likewife in cafe of war or invafion, obliged to victual and furnifh them with munition out of the iffues of his county; to which he was directed by writ of privy feal.

The materials of which caftles were built, varied according to the places of their erection; but the manner of their conftruction feems to have been pretty uniform. The outfide of the walls were generally built with the ftones neareft at hand, laid as regularly as their fhapes would admit; the infides were filled up with the like materials, mixed with a great quantity of fluid mortar, which was called by the workmen grout-work.

The general fhape or plan of thefe caftles depended entirely on the caprice of the architects, or the form of the ground intended to be occupied: neither do they feem to have confined themfelves to any particular figure in their towers; fquare, round, and poligonal, oftentimes occurring in the original parts of the fame building.

The fituation of the caftles of the Anglo-Norman kings and barons, was moft commonly on an eminence, and near a river; a fituation on feveral accounts eligible. The whole fite of the caftle (which was frequently of great extent and irregular figure) was furrounded by a deep and broad ditch, fometimes filled with water, and fometimes dry, called the *foffe*. Before the great gate was an outwork, called a *barbacan*, or *antemural*, which was a ftrong and high wall, with turrets upon it, defigned for the defence of the gate and draw-bridge. On the infide of the ditch ftood the wall of the caftle, about eight or ten feet thick, and between 20 and 30 feet high, with a parapet, and a kind of embrafures, called *crennels*, on the top. On this wall at proper diftances fquare towers of two or three ftories high were built, which ferved for lodging fome of the principal officers of the proprietor of the caftle, and for other purpofes; and on the infide were erected lodgings for the common fervants or retainers, granaries, ftorehoufes, and other neceffary offices. On the top of this wall, and on the flat roofs of thefe buildings, ftood the defenders of the caftle, when it was befieged and from thence difcharged arrows, darts, and ftones, on the befiegers. The great gate of the caftle ftood in the courfe of this wall, and was ftrongly fortified with a tower on each fide, and rooms over the paffage, which was clofed with thick folding-doors of oak, often plated with iron, and with an iron portcullis or grate let down from above. Within this outward wall was a large open fpace or court called, in the largeft and moft perfect caftles, the *outer bayle*, or *ballium*, in which ftood commonly a church or chapel. On the infide of this outer bayle was another ditch, wall, gate, and towers, inclofing the inner bayle or court, within which the chief tower or *keep* was built. This was a very large fquare fabric, four or five ftories high, having fmall windows in prodigious thick walls, which rendered the apartments within it dark and gloomy. This great tower was the palace of the prince, prelate, or baron, to whom the caftle belonged, and the refidence of the conftable or governor. Under ground were difmal dark vaults, for the confinement of prifoners, which made it fometimes be called the *dungeon*. In this building alfo was the great hall, in which the owner difplayed his hofpitality, by entertaining his numerous friends and followers. At one end of the great halls of caftles, palaces, and monafteries, there was a place raifed a little above the reft of the floor, called the *deis*, where the chief table ftood, at which perfons of the higheft rank dined. Though there was unqueftionably great variations in the ftructure of caftles, yet the moft perfect and magnificent of them feem to have been conftructed nearly on the above plan. Such, to give one example, was the famous caftle of Bedford, as appears from the following account of the manner in which it was taken by Henry III. A. D. 1224. The caftle was taken by four affaults. "In the firft was taken the barbican; in the fecond the outer ballia; at the third attack, the wall by the old tower was thrown down by the miners, where, with great danger, they poffeffed themfeves of the inner ballia, through a chink; at the fourth affault the miners fet fire to the tower, fo that the fmoke burft out, and the tower itfelf was cloven to that degree, as to fhow vifibly fome broad chinks: whereupon the enemy furrendered." See a reprefentation of a caftle in Plate CXXVII. where 1 is the barbacan, 2, the ditch or moat, 3 the wall of the outer ballium, 4 outer ballium, 5 the artificial mount, 6 the wall of the inner ballium, 7 the inner ballium, 8, the keep or dungeon.

Before the acceffion of James VI. to the throne of England, the fituation of Scotland was fuch, that every baron's houfe was more or lefs fortified, according to the power and confequence of its lord, or according to the fituation of the caftle. Near Edinburgh or Stirling, where the inhabitants were more polifhed in theirm anners, and overawed by the feat of government, no more was neceffary than towers capable of refifting the curfory attack of robbers and thieves, who never durft ftop to make a regular inveftment, but plundered by furprife, and, if repulfed, inftantly fled away. Such was Melville Caftle. It anciently confifted of a ftrong built tower of three ftories, embattled at the top, and was fufficiently ftrong to refift a fudden attack, unaided by artillery, or other engines of war. But, when further removed, as in Perthfhire, Invernefsfhire, or Aberdeenfhire, then it was neceffary to be better defended, and the aids of a peel or dungeon, with outer walls, moat, and wet ditch, barnakin, &c. added to enable the powerful lord to refift the formidable attack of his powerful adverfary. The hiftory of Scotland, fo late as the reign of the Stewart family, affords a number of melancholy inftances of inveterate feuds among the greater and leffer barons of that period; by which every mode of fortification then in ufe was feldom adequate to the defence of the caftle againft the ftorm or blockade of the enraged chieftain. The caftle of Doun feems to anfwer this defcription of fortification, and has made feveral gallant defences, in the annals of Scotland. The third kind of fortreffes we meet with in Scotland are thofe fituated on the borders of England, or on the fea-coafts of the kingdom, and in the weftern ifles, and very remote places. Many of the old caftles in Scotland were fituated on an ifland, in a deep lake, or on a peninfula, which by a broad deep cut was made an ifland. Of this kind was Lochmaben, in the

ftewartry

stewartry of Annandale, the castle of Closeburn in the shire of Nithsdale, the castle of the Rive, situated on the river Dee, in the shire of Galloway, Lochleven castle, and many others.

This kind of fortress was only accessible in a hard frost or by boats which were not easily transported, by a people distitute of good roads and wheel-carriages. In fact, they could only be taken by surprise or blockade; the first very difficult, the second very tedious; so that, before the use of artillery, they might be deemed almost impregnable. On that account, their situation was very desirable in the inland parts of Scotland.

On the sea-coasts of Scotland we generally find the strongest and most ancient, as well as the most impregnable castles. These had to defend themselves from the invasion of the foreign enemy, as well as the attacks of the domestic foe. Thus we find the barons, whose lands extended to the sea-coast, perched, like the eagle, on the most inaccessible rocks that lay within their possessions. Of this kind were Slains castle, Tantallon, and Dunotter on the east coast, and Dunvegan in the isle of Sky, with Dunolly on the west coast. These must have been most uncomfortable retreats, except to a barbarous people, or when a pressing danger forced the baron to seek his safety in the only possible retreat left him.

CASTLE, in ancient writers, denotes a town or village surrounded with a ditch and wall, furnished with towers at intervals, and guarded by a body of troops. The word is originally Latin, *castellum*, a diminutive from *castrum*. *Castellum* originally seems to have signified a smaller fort for a little garrison: though Suetonius uses the word where the fortification was large enough to contain a cohort. The *castella*, according to Vegetius, were often like towns, built on the borders of the empire, and where there were constant guards and fences against the enemy. Horsley takes them for much the same with what were otherwise denominated *stations*.

CASTLE, or *Castle-steed*, is also an appellation given by the country-people in the north of Britain to the Roman *castella*, as distinguished from the *castra stativa* which they usually call *chesters*. Horsley represents this as an useful criterion, whereby to discover or distinguish a Roman camp or station. There are several of these castella on Severus's wall: they are generally 60 feet square; their north side is formed by the wall itself which falls in with them; the intervals between them are from six furlongs and an half to seven; they seem to have stood closest where the stations are widest. The neighbouring people call them *castles* or *castle-steed*, by which it seems probable that their ancient Latin name had been *castellum*. Some modern writers call them *mile-castles*, or military *castellæ*: Horsley sometimes *exploratory castles*. In these *castella* the *areans* had their stations, who were an order of men whose business was to make incursions into the enemies country, and give intelligence of their motions.

CASTLE, in the sea language, is a part of the ship, of which there are two: the forecastle, being the elevation at the prow, or the uppermost deck towards the mizen, the place where the kitchens are. Hindcastle is the elevation wich reigns on the stern, over the last deck, where the officers cabins and places of assembly are.



CASTLE, (Edmund). See CASTLE.

*CASTLE-Bar*, a borough and market-town, capital of the county of Mayo in Ireland, is a well-inhabited place, and carries on a brisk tade: it has a barrack for a troop of horse; and there is here a charter-school capable of receiving fifty children, and endowed with two acres of land, rent-free, by the Right Honourable Lord Lucan, who has also granted a lease of twenty acres more at a pepper-corn yearly.

*CASTLE-Cary*, a remarkable Roman station about four miles west from Falkirk on the borders of Stirlingshire in Scotland. It comprehends several acres of ground, is of a square form, and is surrounded with a wall of stone and mortar: all the space within the walls has been occupied by buildings, the ruins of which have raised the earth eight or ten feet above its natural surface; so that the fort now seems like an hill-top surrounded with a sunk fence. In 1770, some workmen employed in searching for stones for the great canal which passes very near it, discovered several apartments of stone; and in one of them a great number of stones about two feet in length, and standing erect, with marks of fire upon them, as if they had been employed in supporting some vessels under which fire was put. In a hollow of the rock near this place, in 1771, a considerable quantity of wheat quite black with age was found, with some wedges and hammers supposed to be Roman.

*CASTLE-Rising*, a borough-town of Norfolk in England, which sends two members to parliament. E. Long. 0. 40. 40. N. Lat. 52. 46.

*CASTLE-work*, service or labour done by inferior tenants for the building and upholding castles of defence, toward which some gave their personal assistance and others paid their contributions. This was one of the three necessary charges to which the Anglo-Saxons were expresly subject.

CASTLETOWN, the capital of the isle of Man, seated on the south-west part of the island. It has a strong castle; but of no great importance, on account of its distance from the rocky and shallow harbour. W. Long. 4. 39. N. Lat 53. 30.

CASTOR, the BEAVER, in zoology, a genus of quadrupeds belonging to the order of glires. The fore-teeth of the upper jaw are truncated, and hollowed in a transverse angular direction. The tops of the fore-teeth of the lower jaw lie in a transverse direction; and the tail is depressed. There are three species of castor, viz.

1. The fiber or common beaver, with a plain ovated tail, is found on the banks of the rivers in Europe, Asia, and America. It has short ears hid in the fur: a blunt nose; the fore-feet small, the hinder large: its length from nose to tail about three feet, tail about one foot. It Plate. is from the inguinal glands of this animal that the castor is obtained; it is contained in cods or pouches resembling a dog's testicles. CXXXI. Nothing equals the art with which these animals construct their dwellings. They choose a level piece of ground, with a small rivulet running through it. This they form into a pond, by making a dam across; first by driving into the ground stakes of five or six feet in length, placed in rows, wattling each row with pliant twigs, and filling the interstices with clay, ramming it down close. The side next the water is sloped, the other perpendicular;

Castor. cular; the bottom is from ten to twelve feet thick; but the thickness gradually diminishes to the top, which is about two or three: the length of these dams is sometimes not less than 100 feet.

Their houses are made in the water collected by means of the dam, and are placed near the edge of the shore. They are built on piles; are either round or oval; but their tops are vaulted, so that their inside resembles an oven, the top a dome. The walls are two feet thick, made of earth, stones, and sticks, most artificially laid together; and the walls within as neatly plastered as if with a trowel. In each house are two openings, the one into the water, the other towards the land. The height of these houses above the water is eight feet. They often make two or three stories in each dwelling, for the convenience of change in case of floods. Each house contains from 20 to 30 beavers; and the number of houses in each pond is from 10 to 25. Each beaver forms its bed of moss; and each family forms its magazine of winter provisions, which consist of bark and boughs of trees. Those they lodge under water, and fetch into their apartments as occasion requires. Lawson says, they are fondest of the sassafras, ash, and sweet gum. Their summer food is leaves, fruits, and sometimes crabs and craw fish; but they are not fond of fish.

To effect these works, a community of two or three hundred assembles; each bears his share in the labour; some fall to gnawing with their teeth trees of great size, to form beams or piles; others roll the pieces along to the water; others dive, and with their feet scrape holes in order to place them in; while others exert their efforts to rear them in their proper places: another party is employed in collecting twigs to wattle the piles with; a third in collecting earth, stones, and clay; a fourth is busied in beating and tempering the mortar; others in carrying it on their broad tails to proper places, and with the same instrument ram it between the piles, or plaster the inside of their houses. A certain number of smart strokes given with their tails, is a signal made by the overseer for repairing to such and such places, either for mending any defects, or at the approach of an enemy; and the whole society attend to it with the utmost assiduity. Their time of building is early in summer; for in winter they never stir but to their magazines of provisions, and during that season are very fat. They breed once a-year, and bring forth at the latter end of the winter two or three young at a birth.

Besides these associated beavers, is another sort called *terriers*, which either want industry or sagacity to form houses like the others. They burrow in the banks of rivers, making their holes beneath the freezing depth of the water, and work up for a great number of feet. These also form their winter stock of provision.

Beavers vary in their colours; the finest are black, but the general colour is a chesnut brown, more or less dark: some have been found, but very rarely, white. The skins are a prodigious article of trade, being the foundation of the hat-manufactory. In 1763, were sold, in a single sale of the Hudson's bay company, 54,670 skins. They are distinguished by different names. *Coat-beaver* is what has been worn as coverlets by the Indians: *Parchment-beaver*, because the lower side resembles it: *Stage-beaver* is the worst, and is that which the Indians kill out of season, on their stages or journeys.

In hunting the beavers, the savages sometimes shoot them, always getting on the contrary side of the wind; for they are very shy, quick in hearing, and of a keen scent. This is generally done when the beavers are at work, or on shore feeding on poplar bark. If they hear any noise when at work, they immediately jump into the water, and continue there some time; and when they rise, it is at a distance from the place where they went in.

They sometimes are taken with traps: these are nothing but poplar sticks laid in a path near the water; which when the beaver begins to feed upon, they cause a large log of wood to fall upon their necks, which is put in motion by their moving of the sticks, and consequently requires an ingenious contrivance. The savages generally prefer this way of taking them, because it does not damage their skins.

In the winter time they break the ice in two places at a distance from the house, the one behind the other. Then they take away the broken ice with a kind of racket, the better to see where to place their stakes. They fasten their nets to these, which have large meshes, and sometimes are eighteen or twenty yards in length. When these are fixed, they proceed to demolish the house, and turn a dog therein; which terrifying the beaver, he immediately leaves it, and takes to the water; after which, he is soon entangled by the net.

2. The moschatus, with a long, compressed, lanceolated tail, and palmated feet. It has a long slender nose like that of a shrew-mouse; no external ears, and very small eyes. Length from nose to tail, seven inches; of the tail, eight. It is the water-rat of Clusius; and inhabits Lapland, Russia, the banks of the rivers Wolga and the Yaick. It never wanders far from the sides; is very slow in its pace; makes holes in the cliffs, with the entrance far beneath the lowest fall of the water; works upwards, but never to the surface, only high enough to be beyond the highest flow of the river: feeds on fish; is devoured by the pikes and *siluri*, and gives those fish so strong a flavour of musk as to render them not eatable; has the same scent as the former, especially about the tail, out of which is expressed a sort of musk very much resembling the genuine kind. The skins are put into chests among clothes, to drive away moths. At Orenburgh the skins and tails sell for 15 or 20 copees *per* hundred. They are so common near Nizney Novogorod, that the peasants bring 500 a-piece to market, where they are sold for one ruble *per* hundred. The German name for these animals is *biesemratze*: the Russian *wychozhol*.

3. The zibethicus, or musk-rat, with a long, compressed, lanceolated tail, and the toes of the feet separated from each other. Length from nose to tail, one foot; of the tail, nine inches. This species inhabits North America, breeds three or four times in a year, and brings from three to six young ones at a time: during summer the male and female consort together: at the approach of winter they unite in families, and retire into small round edifices covered with a dome, formed of herbs and reeds cemented with

Castor.

with clay: at the bottom are several pipes through which they pass in search of food; for they do not form magazines like the beavers: during winter their habitations are covered many feet deep with snow and ice; but they creep out and feed on the roots beneath: they quit their old habitations annually, and form new ones: the fur is soft and much esteemed: the whole animal, during summer, has a most exquisite smell of musk, which it loses in winter: perhaps the scent is derived from the calamus aromaticus, a favourite food of this animal. Lescarbot says they are very good to eat.

CASTOR, in astronomy, a moiety of the constellation GEMINI; called also APOLLO. Its latitude northwards, for the year 1700, according to Hevelius, was 10° 4′ 23″; and its longitude, of Cancer, 16° 4′ 14″. It is also called Rasalgenze, Apollo, Aphellan, Avellar, and Anelar.

*CASTOR and Pollux*, in Pagan mythology. Jupiter having an amour with Leda, the wife of Tyndarus king of Sparta, in the form of a swan, she brought forth two eggs, each containing twins. From that impregnated by Jupiter proceeded Pollux and Helena, who were both immortal; from the other Castor and Clytemnestra, who being begot by Tyndarus were both mortal. They were all, however, called by the common name of *Tyndaridæ*. These two brothers entered into an inviolable friendship: they went with the other noble youths of Greece in the expedition to Colchis, and, on several occasions, signalized themselves by their courage; but Castor being at length killed, Pollux obtained leave to share his own immortality with him; so that they are said to live and die alternately every day: for, being translated into the skies, they form the constellation of gemini, one of which stars rises as the other sets.

A martial dance, called the *Pyrrhic* or *Castorian* dance, was invented in honour of those deities whom the Cephelenses placed among the Dii Magni, and offered to them white lambs. The Romans also paid them particular honours on account of the assistance they are said to have given them in an engagement against the Latins; in which, appearing mounted on white horses, they turned the scale of victory in their favour, for which a temple was erected to them in the forum.

*CASTOR* and *Pollux*, a fiery meteor, which at sea appears sometimes sticking to a part of the ship, in form of one, two, or even three or four fire-balls: when one is seen alone, it is more properly called *Helena*; two are denominated Castor and Pollux, and sometimes Tyndaridæ. Castor and Pollux are called by the Spaniards, San Elmo; by the French, St Elme, St Nicholas, St Clare, St Helene; by the Italians, Hermo; by the Dutch, Vree Vuuren.

Castor and Pollux are commonly judged to portend a cessation of the storm, and a future calm; being rarely seen till the tempest is nigh spent. Helena alone portends ill, and witnesses the severest part of the storm yet behind. When the meteor sticks to the masts, yards, &c. they conclude, from the air's not having motion enough to dissipate this flame, that a profound calm is at hand; if it flutter about, it indicates a storm.

Castoreum, Castration.

CASTOREUM, in the Materia Medica, CASTOR; the inguinal glands of the beaver. The ancients had a notion that it was lodged in the testicles; and that the animals, when hard pressed, would bite them off, and leave them to its pursuers, as if conscious of what they wanted to destroy him for. The best sort of castor is what comes from Russia. So much is Russian castor superior to the American, that two guineas per pound is paid in Britain for the former, and only 8s 6d. for the latter. The Russian castor is in large hard round cods, which appear, when cut, full of a brittle, red, liver-coloured substance, interspersed with membranes and fibres exquisitely interwoven. An inferior sort is brought from Dantzic, and is generally fat and moist. The American castor, which is the worst of all, is in longish thin cods. Russia castor has a strong disagreeable smell; and an acrid, bitterish, and nauseous taste. Water extracts the nauseous part, with little of the finer bitter; rectified spirit extracts this last without much of the nauseous; proof-spirit both: water elevates the whole of its flavour in distillation; rectified spirit brings over nothing. Castor is looked upon as one of the capital nervine and antihysteric medicines: some celebrated practitioners, nevertheless, have doubted its virtues; and Newman and Stahl declare it insignificant. Experience, however, has shown that the virtues of castor are considerable, tho' less than they have been generally supposed.

CASTRATION, in surgery, the operation of gelding, *i. e.* of cutting off the testicles, and putting a male animal out of a capacity of generation.

Castration is much in use in Asia, especially among the Turks, who practise it on their slaves, to prevent any commerce with their women. The Turks often make a general amputation.

Castration also obtains in Italy, where it is used with a view to preserve the voice for singing. See EUNUCH.

The Persians, and other eastern nations, have divers methods of making eunuchs, different from those which obtain in Europe: we say, of making eunuchs, for it is not always done among them by cutting, or even collision. Cicuta and other poisonous herbs do the same office, as is shewn by Paulus Ægineta. Those eunuchised in this manner are called *thlibiæ*. Besides which there is another sort named *thlasiæ*, in whom the genitals are left entire, and only the veins which should feed them are cut; by which means the parts do indeed remain, but so lax and weak, as to be of no use.

Castration was for some time the punishment of adultery. By the laws of the Visigoths, sodomites underwent the same punishment.

By the civil law, it is made penal in physicians and surgeons to castrate, even with consent of the party, who is himself included in the same penalty, and his effects forfeited. The offence of Mayhem by castration is, according to all old writers, felony; though committed upon the highest provocation. See a record to this purpose of Henry III. transcribed by Sir Edward Coke, 3 Inst. 62. or Blackstone's Com. vol. iv. p. 206.

Castration is sometimes found necessary on medicinal considerations, as in mortifications, and some other diseases of the testicles, especially the *sarcocele* and *varicocele*. Some have also used it in maniac cases.

Castration, Castruccio.

Castration is also in some sort practised on women. Athenæus mentions, that king Andramytes was the first who castrated women. Hesychius and Suidas say Gyges did the same thing. Galen observes, that women cannot be castrated without danger of life, and Dalechampius, on the forementioned passage of Athenæus, holds, that it is only to be understood of simple padlocking.

Castration, in respect of brutes, is called Gelding and Spaying.

Castration also denotes the art of retrenching, or cutting away any part of a thing from its whole.—Castrating a book, among booksellers, is the taking out some leaf, sheet, or the like, which renders it imperfect and unfit for sale. The term is also applied to the taking away particular passages, on account of their obscenity, too great freedom with respect to goverment, &c.

Castration, among botanists, a term derived from the fancied analogy betwixt plants and animals. The castration of plants consists in cutting off the *antheræ*, or tops of the stamina, before they have attained maturity and dispersed the pollen or fine dust contained within their substance. This operation has been frequently practised by the moderns, with a view to establish or confute the doctrine of the sexes of plants; the antheræ or tops being considered by the sexualists as the male organs of generation. The experiment of castration succeeds principally on plants which, like the melon, have their male flowers detached from the female. In such as have both male and female flowers contained within the same covers, this operation cannot be easily performed without endangering the neighbouring organs. The result of experiments on this subject by Linnæus, Alston, and other eminent botanists, may be seen under the article Botany, sect. iii.

CASTREL, a kind of hawk resembling the lanner in shape, but the hobby in size. The castrel is also called kestrel, and is a slow and cowardly kind; her game is the grous, though she will kill a partridge.

CASTRES, a city of Languedoc in France, about 35 miles east of Thoulouse. E. Long. 2. and N. Lat. 43. 40. It is a bishop's see.

CASTRO, the capital of the island of Chiloe, on the coast of Chili in South America. W. Long. 82. S. Lat. 43.

Castro is also the capital of a duchy of the same name in the Pope's territories in Italy, situated on the confines of Tuscany. E. Long. 12. 35. N. Lat. 42. 30.

Castro, (Pietro de) a celebrated painter, who flourished about the middle of the 17th century. The subjects which this great artist chose to paint, were what are distinguished by the name of still life, vases, shells, musical instruments, gems, vessels of gold, silver, and crystal, books, and rich bracelets; and in those subjects his choice and disposition were elegant, and his execution admirable.

CASTRUCCIO, (Castracani) a celebrated Italian general, was born (nobody knows of whom) at Lucca in Florence in 1284, and left in a vineyard covered with leaves, where he was found by Dianora a widow lady, the sister of Antonio, a canon of St Michael in Lucca, who was descended from the illustrious family of the Castracani. The lady having no children, they resolved to bring him up, and educated him as carefully as if he had been their own. They intended him for a priest; but he was scarcely 14 years old when he began to devote himself to military sports, and those violent exercises which suited his great strength of body. The factions named the *Guelfs* and *Gibelines* then shared all Italy between them; divided the popes and the emperors; and engaged in their different interests not only the members of the same town, but even those of the same family. Francisco, a considerable person on the side of the Gibelines, observing Castruccio's uncommon spirit and great qualities, prevailed with Antonio to let him turn soldier; on which Castruccio soon became acquainted with every thing belonging to that profession, and was made a lieutenant of a company of foot by Francisco Guinigi. In his first campaign he gave such proofs of his courage and conduct as spread his fame all over Lombardy; and Guinigi, dying soon after, committed to him the care of his son and the management of his estate. Still distinguishing himself by his exploits, he filled his commander in chief with such jealousy and envy, that he was imprisoned by stratagem in order to be put to death. But the people of Lucca soon released him, and afterwards chose him for their sovereign prince.

Castruccio.

The Gibelines considered him as the chief of their party; and those who had been banished from their country fled to him for protection, and unanimously promised that if he could restore them to their estates, they would serve him so effectually that the sovereignty of their country should be his reward. Flattered by these promises, he entered into a league with the prince of Milan. He kept his army constantly on foot, employing it as best suited his own designs. For services he had done the pope, he was made senator of Rome with more than ordinary ceremony; but while there, received news which obliged him to hasten back to Lucca. The Florentines entered into a war with him, but Castruccio fought his way through them; and the supreme authority of Tuscany was ready to fall into his hands, when a period was put to his life. In May 1328, he gained a complete victory over his enemies, who amounted to 30,000 foot and 10,000 horse; in which 22,000 of them were slain, with the loss of not quite 16,000 of his own men: but as he was returning from the field of battle, tired with the action, and covered with sweat, he halted a little, in order to thank and caress his soldiers as they passed; when, the north wind blowing upon him, he was immediately seized with an ague, which he at first neglected, but it carried him off in a few days, in the 44th year of his age.

Machiavel, who has written the life of Castruccio, says, that he was not only an extraordinary man in his own age, but would have been so in any other. He was of a noble aspect, and of the most winning address. He had all the qualities that make a man great; was grateful to his friends, just to his subjects, terrible to his enemies. No man was more forward to encounter dangers; no man more careful to escape them. He had an uncommon presence of mind, and often made repartees with great smartness. Some of them are recorded, which discover a singular turn of humour; and,

and, for a specimen, we shall mention three or four of them.—Passing one day through a street where there was a house of bad fame, he surprised a young man, who was just coming out, and who, upon seeing him, was all over blushes and confusion: "Friend, you should not be ashamed when you come out, but when you go in."—One asking a favour of him with a thousand impertinent and superfluous words: "Hark you, friend; when you would have any thing with me for the future, send another man to ask it."—Another great talker having tired him with a tedious discourse, excused himself at last, by saying, he was afraid he had been troublesome. "No indeed, (replied he), for I did not mind one word you said."—He was forced to put a citizen of Lucca to death, who had formerly been a great instrument of his advancement; and being reproached by somebody for having dealt so severely with an old friend, replied, "No, you are mistaken, it was with a new foe."—One of his courtiers, desirous to regale him, made a ball and invited him to it. Castruccio came, entertained himself among the ladies, danced, and did other things which did not seem to comport with the dignity of his rank. One of his friends intimating that such freedoms might diminish the reverence that ought to be paid him: "I thank you for your caution; but he who is reckoned wise all the day, will never be reckoned a fool at night."

CASTRUM DOLORIS, in middle-aged writers, denots a catafalco, or a lofty tomb of state, erected in honour of some person of eminence, usually in the church where his body is interred; and decorated with arms, emblems, lights, and the like.

Ecclesiastical writers speak of a ceremony of consecrating a *castrum doloris;* the edifice was to be made to represent the body of the deceased, and the priest and deacon were to take their posts, and say the prayers after the same manner as if the corpse were actually present.

CASTS. See CASTING.

CASU CONSIMILI, in law a writ of entry granted where a tenant, by courtesy or for life, aliens either in fee, in tail, or for the term of another's life. It is brought by him in reversion against the person to whom such tenant does so alien to the prejudice of the reversioner in the tenant's life-time.

*Casu-Proviso*, in law, a writ of entry founded on the statute of Gloucester, where a tenant in dower aliens the lands she so holds in fee, or for life; and lies for the party in reversion against the alience.

CASUAL, something that happens fortuitously, without any design, or any measures taken to bring it to pass.

*Casual-Revenues*, are those which arise from forfeitures, confiscations, deaths, attainders, *&c.*

*Casual-Theology*, a denomination given to what is more frequently called CASUISTRY.

CASUALTY, in general sense, denotes an accident, or a thing happening by chance, not design. It is particularly used for an accident producing unnatural death.

CASUALTY, in Scots law. *Casualties of a superior*, are those duties and emoluments which a superior has right to demand out of his vassal's estate, over and besides the constant yearly duties established by the *reddendo* of his charter upon certain casual events.



CASUALTY, in Metallurgy. See CASUALTY.

CASUIST, a person who proposes to resolve cases of conscience. Escobar has made a collection of the opinions of all the casuists before him. M. Le Feore, preceptor of Louis XIII. called the books of the casuists the art of quibbling with God; which does not seem far from truth, by reason of the multitude of distinctions and subtleties they abound withal. Mayer has published a bibliotheca of casuists, containing an account of all the writers on cases of conscience, ranged under three heads; the first comprehending the Lutheran, the second the Calvinist, and the third the Romish casuists.

CASUISTRY, the doctrine and science of conscience and its cases, with the rules and principles of resolving the same; drawn partly from natural reason or equity; partly from authority of scripture, the canon law, councils, fathers, *&c.* To casuistry belongs the decision of all difficulties arising about what a man may lawfully do or not do; what is sin or not sin; what things a man is obliged to do in order to discharge his duty, and what he may let alone without breach of it.

CASUS AMISSIONIS, in Scots law, in actions proving the tenor of obligations inextinguishable by the debtors retiring or cancelling them, it is necessary for the pursuer, before he is allowed a proof of the tenor, to condescend upon such a *casus amissionis*, or accident by which the writing was destroyed, as shows it was lost while in the writer's possession.

CAT, in zoology. See FELIS.

CAT, in sea-affairs, a ship employed in the coal-trade, formed from the Norwegian model. It is distinguished by a narrow stern, projecting quarters, a deep *waiste*, and by having ornamental figures on the prow. These vessels are generally built remarkably strong, and carry from four to six hundred tons, or, in the language of their own mariners, from 20 to 30 *keels* of coals.

CAT, is also a sort of strong tackle, or combination of pullies, to hook and draw the anchor perpendicularly up to the *cat-head*. See *Cat-Heads*.

*Cat's Eye*, or *Sun-stone*, of the Turks, a kind of gem found chiefly in Siberia. Cat's-eye is by the Latins called *occulus cati*, and sometimes *onycopalus*, as having white zones or rings like the onyx; and its colours variable like OPAL, from which last it differs chiefly by its superior hardness. It is very hard, and semitransparent and has different points, from whence the light is reflected with a kind of yellowish radiation somewhat similar to the eyes of cats, from whence it had its name. The best of them are are very scarce, and jewellers cut them round to the greatest advantage. One of these stones, an inch in diameter, was in the possession of the duke of Tuscany.

*Cat-Fish*, in ichthyology. See SQUALUS.

*Cat-Gut*, a denomination given to small strings for fiddles, and other instruments, made of the intestines of sheep or lambs, dried and twisted together, either singly, or several together. These are sometimes coloured red, sometimes blue, but are commonly left whitish or brownish, the natural colour of the gut.

Cat-harpings ‖ Catacomb.

They are alſo uſed by watch-makers, cutlers, turners, and other artificers. Great quantities are imported into England, and other northern countries, from Lyons and Italy.

*Cat-Harpings*, a purchaſe of ropes employed to brace in the ſhrowds of the lower maſts behind their yards, for the double purpoſe of making the ſhrowds more tight, and of affording room to draw in the yards more obliquely, to *trim* the ſails for a ſide-wind, when they are ſaid to be cloſe hauled.

*Cat-Heads*, two ſtrong ſhort beams of timber, which project almoſt horizontally over the ſhip's bows on each ſide of the bow-ſprit; being like two radii which extend from a centre taken in the direction of the bow-ſprit. That part of the cat-head which reſts upon the forecaſtle, is ſecurely bolted to the beams: the other part projects like a crane as above deſcribed, and carries in its extremity two or three ſmall wheels or *ſheaves* of braſs or ſtrong wood, about which a rope called the *cat-fall* paſſes, and communicates with the cat-block, which alſo contains three ſheaves. The machine formed by this combination of pullies is called the *Cat*, which ſerves to pull the anchor up to the cat-head, without tearing the ſhip's ſides with its flukes. The cat-head alſo ſerves to ſuſpend the anchor clear of the bow, when it is neceſſary to let it go: it is ſupported by a ſort of knee, which is generally ornamented with ſculpture. See Plate CXXVIII.

The cat-block is filled with a large and ſtrong hood, which catches the ring of the anchor when it is to be drawn up.

*Cat-Mint*. See Mentha.

*Cat-Salt*, a name given by the ſalt-workers to a very beautifully granulated kind of common ſalt. It is formed out of the bittern, or leach-brine, which runs from the ſalt when taken out of the pan. When they draw out the common ſalt from the boiling pans, they put it into long wooden troughs, with holes bored at the bottom for the brine to drain out; under theſe troughs are placed veſſels to receive this brine, and acroſs them ſmall ſticks to which the cat-ſalt affixes itſelf in very large and beautiful cryſtals. This ſalt contains ſome portion of the bitter purging ſalt, is very ſharp and pungent, and is white when powdered, though pellucid in the maſs. It is uſed by ſome for the table, but the greateſt part of what is made of it is uſed by the makers of hard-ſoap.

*Cat-Silver*. See Mica.

CATACAUSTIC curves, in the higher geometry, that ſpecies of cauſtic curves which are formed by reflection. See Fluxions.

CATACHRESIS, in rhetoric, a trope which borrows the name of one thing to expreſs another. Thus Milton, deſcribing Raphael's deſcent from the empyreal heaven to paradiſe, ſays,

"Down thither prone in flight,
"He ſpeeds, and through the vaſt etherial ſky
"Sails between worlds and worlds."

CATACOMB, a grotto, or ſubterraneous place for the burial of the dead.

Some derive the word *catacomb* from the place where ſhips are laid up, which the modern Latins and Greeks call *cumbæ*. Others ſay, that *cata* was uſed for *ad*, and *catacumbas* for *adtumbas*: accordingly, Dadin ſays, they anciently wrote *catatumbas*. Others fetch the word from the Greek κατα, and κυμϐος, a hollow, cavity, or the like.

Catacombs.

Anciently the word *catacomb* was only underſtood of the tombs of St Peter and St Paul; and M. Chaſtelain obſerves, that, among the more knowing of the people of Rome, the word *catacomb* is never applied to the ſubterraneous burying-places hereafter mentioned, but only to a chapel in St Sebaſtian, one of the ſeven ſtational churches; where the ancient Roman kalendars ſay the body of St Peter was depoſited, under the conſulate of Tuſcus and Baſſus, in 258.

Catacombs of Italy; a vaſt aſſemblage of ſubterraneous ſepulchres about Rome, chiefly at about three miles from that city in the Via Appia; ſuppoſed to be the ſepulchres of the martyrs; and which are viſited accordingly out of devotion, and relics thence taken and diſperſed throughout the catholic countries, after having been firſt baptiſed by the pope under the name of ſome ſaint. Theſe *catacombs* are ſaid by many to be caves or cells wherein the primitive Chriſtians hid and aſſembled themſelves together, and where they interred ſuch among them as were martyred. Each *catacomb* is three feet broad, and eight or ten high; running in form of an alley or gallery, and communicating with others: in many places they extend within a league of Rome. There is no maſonry or vaulting therein; but each ſupports itſelf: the two ſides, which we may look on as the *parietes* or walls, were the places where the dead were depoſited; which were laid lengthwiſe, three or four rows over one another, in the ſame *catacomb*, parallel to the alley. They were commonly cloſed with large thick tyles, and ſometimes pieces of marble, cemented in a manner inimitable by the moderns. Sometimes, though very rarely, the name of the deceaſed is found on the tyle: frequently a palm is ſeen, painted or engraven, or the cipher Xp, which is commonly read *pro Chriſto*. The opinion held by many Proteſtant authors is, that the *catacombs* are heathen ſepulchres, and the ſame with the puticuli mentioned by Feſtus Pompeius; maintaining, that whereas it was the practiſe of the ancient Romans to burn their dead, the cuſtom was, to avoid expence, to throw the bodies of their ſlaves to rot in holes of the ground; and that the Roman Chriſtians, obſerving, at length, the great veneration paid to relics, reſolved to have a ſtock of their own; entering therefore the *catacombs*, they added what ciphers and inſcriptions they pleaſed; and then ſhut them up again, to be opened on a favourable occaſion. Thoſe in the ſecret, add they, dying or removing, the contrivance was forgot, till chance opened them at laſt. But this opinion has even leſs of probability than the former. Mr Monro, in the *Philoſophical Tranſactions*, ſuppoſes the *catacombs* to have been originally the common ſepulchres of the firſt Romans, and dug in conſequence of theſe two opinions, *viz*. That ſhades hate the light; and that they love to hover about the places where the bodies are laid.

Though the catacombs of Rome have made the greateſt noiſe of any in the world, there are ſuch belonging to many other cities. Thoſe of Naples, according to biſhop Burnet, are much more noble and ſpacious than the catacombs of Rome. Catacombs



have

have also been discovered at Syracuse, and Catanea in Sicily, and in the island of Malta. The Roman catacombs take particular names from the churches in their neighbourhood, and seem to divide the circumference of the city without the walls between them, extending their galleries every where under, and a vast way from it; so that all the ground under Rome, and for many miles about it, some say 20, is hollow. The largest, and those commonly shown to strangers, are the catacombs of San Sebastiano, those of Saint Agnese, and the others in the fields a little off Saint Agnese. Women are only allowed to go into the catacombs in the church-yard of the Vatican on Whitsun-Monday, under pain of excommunication. There are men kept constantly at work in the *catacombs*. As soon as these labourers discover a grave with any of the supposed marks of a saint upon it, intimation is given to the cardinal Comerlingo, who immediately sends men of reputation to the place, where finding the palm, the monogram, the coloured glass, *&c.* the remains of the body are taken up with great respect, and translated to Rome. After the labourers have examined a gallery, they stop up the entry that leads to it; so that most of them remain thus closed up; only a few being left open to keep up the trade of showing them to strangers. This they say is done to prevent people from losing themselves in these subterraneous labyrinths, which indeed has often happened; but more probably to deprive the public of the means of knowing whither and how far the catacombs are carried.

The method of preserving the dead in catacombs seems to have been common to a number of the ancient nations. The catacombs of Egypt are still extant about nine leagues from the city of Grand Cairo, and two miles from the city of Zaccara. They extend from thence to the pyramids of Pharaoh, which are about eight miles distant. They lie in a field covered with a fine running sand, of a yellowish colour. The country is dry and hilly; the entrance of the tomb is choaked up with sand; there are many open, but more that are still concealed.

The bodies found in catacombs, especially those of Egypt, are called *mummies;* and as their flesh was formerly reckoned an efficacious medicine, they were much sought after. In this work the labourers were often obliged to clear away the sand for weeks together, without finding what they wanted. Upon coming to a little square opening of about 18 feet in depth, they descend into it by holes for the feet, placed at proper intervals; and there they are sure of finding a mummy. These caves, or *wells*, as they call them there, are hollowed out of a white free-stone, which is found in all this country a few feet below the covering of sand. When one gets to the bottom of these, which are sometimes 40 feet below the surface, there are several square openings on each side into passages of 10 or 15 feet wide; and these lead to chambers of 15 or 20 feet square. These are all hewn out in the rock; and in each of the catacombs are to be found several of these apartments communicating with one another. They extend a great way under ground, so as to be under the city of Memphis, and in a manner to undermine its invirons. In some of the chambers the walls are adorned with figures and hieroglyphics; in others the mummies are found in tombs, round the apartment hollowed out in the rock.



The Egyptians seem to have excelled in the art of embalming and preserving their dead bodies; as the mummies found in the Egyptian catacombs are in a better state than the bodies found either in the Italian catacombs, or those of any other part of the world. See EMBALMING and MUMMY.

Laying up the bodies in caves, is certainly the original way of disposing of the dead; and appears to have been propagated by the Phœnicians throughout the countries to which they sent colonies: the interring as we now do in the open air or in temples was first introduced by the Christians. When an ancient hero died or was killed in a foreign expedition, as his body was liable to corruption, and for that reason unfit to be transported entire, they fell on the expedient of burning, in order to bring home the ashes, to oblige the *manes* to follow; that so his country might not be destitute of the benefit of his tutelage. It was thus burning seems to have had its original; and by degrees it became common to all who could bear the expences of it, and took place of the ancient burying: thus *catacombs* became disused among the Romans, after they had borrowed the manner of burning from the Greeks, and then none but slaves were laid in the ground. See BURIAL, *&c.*

CATALAUNI, called also *Durocatalauni*, a town of Gallia Belgica: *Catalauni*, the people. A name rather of the lower age than of classical antiquity. Now *Chalons sur Marne*, in Campaign. E. Long. 4. 35. N. Lat. 48. 55.

CATADROMUS, (from κατα and δρεμω, *I run)*, in antiquity, a stretched sloping rope in the theatres, down which the *funambuli* walked to show their skill.

Some have taken the word to signify the hippodrome or decursorium wherein the Roman knights used to exercise themselves in running and fighting on horseback. But the most natural meaning is that of a rope fastened at one end to the top of the theatre, and at the other to the bottom, to walk or run down, which was the highest glory of the ancient *schœnobates* or *funambuli*. Elephants were also taught to run down the *catadromus*. Suetonius speaks of the exploit of a Roman knight, who passed down the *catadromus* mounted on an elephant's back.

CATAGOGION, a heathen festival at Ephesus, celebrated on the 22d of January, in which the devotees run about the streets, dressed in divers antic and unseemly manners, with huge cudgels in their hands, and carrying with them the images of their gods; in which guise they ravished the women they met with, abused and often killed the men, and committed many other disorders, to which the religion of the day gave a sanction.

CATAGRAPHA, in antiquity, denote oblique figures or views of mens faces; answering to what the moderns call *profiles*.

Catagrapha are said to be the invention of Simon Cleonæus, who first taught painters to vary the looks of their figures, and sometimes direct them upwards, sometimes downwards, and sometimes sidewards or backwards.

CATALEPSIS, or CATALEPSY, in medicine, a kind

kind of apoplexy or a drowsy disease wherein the patient is taken speechless, senseless, and fixed in the same posture wherein the disease first seized him; his eyes open, without seeing or understanding. See MEDICINE-*Index*.

CATALOGUE, a list or enumeration of the names of several books, men, or other things, disposed according to a certain order.

Catalogues of books are digested in different manners, some according to the order of the times when the books were printed, as that of Mattaire; others according to their form and size, as the common booksellers-catalogues; others according to the alphabetical order of the authors names, as Hyde's catalogue of the Bodleian library: others according to the alphabetical order of matters or subjects, which are called *real* or *classical catalogues*, as those of Lipenius and Draudius; lastly, others are digested in a mixed method, partaking of several of the former, as de Seine's catalogue of cardinal Slusius's library, which is first divided according to the subjects or sciences, and afterwards the books in each are recited alphabetically.

The most applauded of all catalogues is that of Thuanus's library, in which are united the advantages of all the rest. It was first drawn up by the two Puteani in the alphabetical order, then digested according to the sciences and subjects, by Ishm. Bullialdus, and published by F. Quesnel at Paris in 1679; and reprinted, though incorrectly, at Hamburg, in 1704. The books are here ranged with justness under their several sciences and subjects, regard being still had to the nation, sect, age, &c. of every writer. Add, that only the best and choicest books in every subject are found here, and the most valuable editions. Yet the catalogue of M. le Telliers archbishop of Rheim's library, made by M. Clement, is not inferior to any published in our age, either on account of the number and choice of the books, or the method of its disposition. One advantage peculiar to this catalogue is, the multitude of anonymous and pseudonymous authors detected in it, scarce to be met with elsewhere. Some even prefer it to Thuanus's catalogue, as containing a greater variety of classes and books on particular subjects.

The conditions required in a catalogue are, that it indicate at the same time the order of the authors and of the matters, the form of the book, the number of volumes, the chronological order of the editions, the language it is written in, and its place in the library; so as that all these circumstances may appear at once in the shortest, clearest, and exactest manner possible. In this view, all the catalogues yet made will be found to be defective.

An anonymous French writer has laid down a new plan of a catalogue, which shall unite all the advantages, and avoid all the inconveniences of the rest.

The Jesuits of Antwerp have given us a catalogue of the popes; which makes what they call their *Propylæum*.

*CATALOGUE of the Stars*, is a list of the fixed stars, disposed in their several constellations; with the longitudes, latitudes, &c. of each.

The first who undertook to reduce the fixed stars into a catalogue was Hipparchus Rhodius, about 120 years before Christ; in which he made use of the observations of Timocharis and Aristyllus for about 180 years before him. Ptolemy retained Hipparchus's catalogue, containing 1026 fixed stars; though he himself made abundance of observations, with a view to a new catalogue, A. D. 140. About the year of Christ 880, Albategni, a Syrian, brought down the same to his time. Anno 1437, Ulugh Begh, king of Parthia and India, made a new catalogue of 1022 fixed stars, since translated out of Persian into Latin by Dr Hyde. The third who made a catalogue from his own observations was Tycho Brahe, who determined the places of 777 stars for the year 1600, which Kepler from other observations of Tycho, afterwards increased to the number of 1000 in the Rudolphine Tables; adding those of Ptolemy omitted by Tycho, and of other authors, so that his catalogue amounts to above 1160. At the same time, William Landgrave of Hesse, with his mathematicians Christopher Rothmannus and Justus Byrgius, determined the places of 400 fixed stars by his own observations, with their places rectified for the year 1593; which Hevelius prefers to those of Tycho's. Ricciolus, in his *Astronomia Reformata*, determined the places of 101 stars for the year 1700, from his own observations: for the rest he followed Tycho's catalogue; altering it where he thought fit. Anno 1667, Dr Halley, in the island of St Helena, observed 350 southern stars not visible in our horizon. The same labour was repeated by F. Noel in 1710, who published a new catalogue of the same stars constructed for the year 1687.



Bayer, in his *Uranometria*, published a catalogue of 1160 stars, compiled chiefly from Ptolemy and Tycho, in which every star is marked with some letter of the Greek alphabet; the biggest star in any constellation being denoted by the first letter, the next by the second, &c. and if the number exceeds the Greek alphabet, the remaining stars are marked by letters of the Roman alphabet, which letters are preserved by Flamstead, and by Senex on his globes. The celebrated Hevelius composed a catalogue of 1888 stars 1553 of which were observed by himself; and their places were computed for the year 1660.

The last and greatest is the Britannic catalogue, compiled from the observations of the accurate Mr Flamstead: who, for a long series of years devoted himself wholly thereto. As there was nothing wanting either in the observer or apparatus, we may look on this as a perfect work so far as it goes. It is to be regretted the impression had not passed through his own hands: that now extant, was published by authority, but without the author's consent: it contains 2734 stars. There was another published in 1725, pursuant to his testament; containing no less than 3000 stars, with their places rectified for the year 1689: to which is added Mr Sharp's catalogue of the southern stars not visible in our hemisphere, adapted to the year 1726.

CATALONIA, a province of Spain, bounded on the north by the Pyrenean mountains, which divide it from France; by the kingdom of Arragon and Valencia on the west; and by the Mediterranean sea on the south and east. It is 155 miles in length, and 100 in breadth. It is watered by a great number of rivers; the principal of which are the Lobregat, the Ter, and the Segra. The air is temperate and healthy; but the land is mountainous, except in a few places. It produces, however, corn, wine, oil, pulse, flax, and hemp, sufficient for the inhabitants. The mountains are covered with large forests of tall trees, such as the oak, the ever-green oak, the beech, the pine, the fir, the chesnut, and many others: with cork-trees, shrubs, and medicinal plants. There are several quarries of marble of all colours, crystal, alabaster, amethysts, and lapis lazuli. Gold dust has been found among the sands of one or two of the rivers; and there are mines of tin, iron, lead, alum, vitriol, and salt. They likewise fish for coral on the eastern coast. The inhabitants are hardy, courageous, active, vigorous, and good soldiers, but apt to be discontented. The miquelets are a sort of soldiers which guard the passes over the mountains, and ought to protect travellers; but if they are not paid to their minds, they seldom fail to pay themselves. The river Lobregat divides Catalonia into two parts, the east and west, according to their situation. This province comprehends 17 vigueries or territories; two of which are in Rousillon, and belong to the French. The rest are subject to the Spaniards. The principal towns are Barcelona the capital, Tarragona, Tortosa, Lerida, Solsonia, Cordona Vich, Girona, Seu d'Urgel, Pui Cerda, and Cervera. Catalonia was the last province in Spain which submitted to Philip in the succession-war.

CATAMENIA, in medicine. See MENSES.

CATAMITE, a boy kept for sodomitical practices.

CATANA, or CATINA, (anc. geog.) a town of Sicily, situated opposite to Ætna, to the south-east; one of the five Roman colonies: anciently built by the people of Naxus seven years after the building of Syracuse, 728 years before Christ. It was the country of Charondas, the famous lawgiver. The town is called *Catanea*. See *CATANEA*.

CATANANCHE, CANDIA LIONS-FOOT: A genus of the polygamia æqualis order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is paleaceous; the calyx imbricated; the pappus furnished with awns by a caliculus of five stiff hairs. There are three species, of which the cerulea is the most remarkable. This sends out many long, narrow, hairy leaves, which are jagged on their edges like those of the buckshorn plantain, but broader; the jags are deeper, and at greater distances: these lie flat on the ground, turning their points upwards. Between the leaves come out the flower stalks, which are in number proportionable to the size of the plants; for, from an old thriving root, there are frequently eight or ten, while young plants do not send out above two or three. These stalks rise near two feet high, dividing into many small branches upward, garnished with leaves like those below, but smaller, and without jags on their edges; each of these smaller branches are terminated by single heads of flowers, of a fine blue colour. This is a perennial plant, and may be propagated by seeds or slips. The seeds may be sown in the spring on a bed of common earth; and in the autumn following the plants may be removed to the places where they are to remain. The seeds ripen in August. This plant is a pretty ornament in gardens, and is easily kept within bounds.



CATANEA, or CATANIA, a city of Sicily, seated on a gulph of the same name, near the foot of Mount Ætna or Gibel. It was founded by the Chalcidians soon after the settlement of Syracuse, and enjoyed great tranquillity till Hiero I. expelled the whole body of citizens; and after replenishing the town with a new stock of inhabitants, gave it the name of *Ætna*: immediately after his decease, it regained its ancient name, and its citizens returned to their abodes. Catania fell into the hands of the Romans, among their earliest acquisitions in Sicily, and became the residence of a prætor. To make it worthy of such an honour, it was adorned with sumptuous buildings of all kinds, and every convenience was procured to supply the natural and artificial wants of life. It was destroyed by Pompey's son, but restored with superior magnificence by Augustus. The reign of Decius is famous in the history of this city for the martyrdom of its patroness St Agatha. On every emergency her intercession is implored. She is piously believed to have preserved Catania from being overwhelmed by torrents of lava, or shaken to pieces by earthquakes; yet its ancient edifices are covered by repeated streams of volcanic matter; and almost every house, even her own church, has been thrown to the ground. In the reign of William the Good, 20,000 Catanians, with their pastor at their head, were destroyed before the sacred veil could be properly placed to check the flames. In the last century the eruptions and earthquakes raged with redoubled violence, and Catania was twice demolished. See ÆTNA.

The present prince of Biscari has been at infinite pains, and spent a large sum of money, in working down to the ancient town, which on account of the numerous torrents of lava that have flowed out of Mount Ætna for these last thousand years, is now to be sought for in dark caverns many feet below the present surface of the earth. Mr Swinburne informs us that he descended into the baths, sepulchres, an amphitheatre, and a theatre, all very much injured by the various catastrophes that have befallen them. They were erected upon old beds of lava, and even built with square pieces of the same substance, which in no instance appears to have been fused by the contact of new lavas: The sciara or stones of cold lava, have constantly proved as strong a barrier against the flowing torrent of fire as any other stone could have been, though some authors were of opinion that the hot matter would melt the old mass and incorporate with it.

This city has been frequently defended from the burning streams by the solid mass of its own ramparts, and by the air compressed between them and the lava; as appears by the torrent having stopt within a small distance of the walls, and taken another direction. But when the walls were broken or low, the lava collected itself till it rose to a great height, and then poured over in a curve. A similar instance is seen at the Terro del Greco near Naples, where the stream of liquid fire from Vesuvius divided itself into two branches, and left a church untouched in the middle. There is a well at the foot of the old walls of Catania, where the lava, after running along the parapet, and then

falling

falling forwards, has produced a very complete lofty arch over the spring.

The church here is a noble fabric. It is accounted the largest in Sicily, though neither a porch nor cupola has been erected, from a doubt of the solidity of the foundations, which are no other than the bed of lava that ran out of Ætna in 1669, and is supposed to be full of cavities. The organ is much esteemed by connoisseurs in musical instruments.

Catania, according to Mr Swinburne's account, is reviving with great splendor. "It has already (he says) much more the features of a metropolis and royal residence than Palermo; the principal streets are wide, straight, and well paved with lava. An obelisk of red granite, placed on the back of an antique elephant of touchstone stands in the centre of the great square, which is formed by the town-hall, seminary, and cathedral. The cathedral erected by the abbot Angerius in the year 1094, was endowed by earl Roger with the territories of Catania and Ætna, for the small acknowledgement of a glass of wine and a loaf of bread offered once a-year. It has suffered so much by earthquakes, that little of the original structure remains, and the modern parts have hardly any thing except their materials to recommend them. The other religious edifices of the city are profusely ornamented, but in a bad taste. The spirit of building seems to have seized upon this people, and the prince of Biscari's example adds fresh vigour. It were natural to suppose men would be backward in erecting new habitations, especially with any degree of luxury, on ground so often shaken to its centre, and so often buried under the ashes of a volcano; but such is their attachment to their native soil, and their contempt of dangers they are habituated to, that they rebuild their houses on the warm cinders of Vesuvius, the quaking plains of Calabria, and the black mountains of Sciarra at Catania; it is however surprising to see such embellishments lavished in so dangerous a situation. There is a great deal of activity in the disposition of this people: they know by tradition that their ancestors carried on a flourishing commerce; and that, before the fiery river filled it up, they had a spacious convenient harbour, where they now have scarce a creek for a felucca: they therefore wish to restore those advantages to Catania, and have often applied to government for assistance towards forming a mole and port, an undertaking their strength alone is unequal to; but whether the refusal originates in the deficiencies of the public treasury or the jealousy of other cities, all their projects have ended in fruitless applications. The number of inhabitants dwelling in Catania amounts to 30,000; the Catanians make it double: A considerable portion of this number appertains to the university, the only one in the island, and the nursery of all the lawyers." E. Long. 15. 19. N. Lat. 37. 30.

CATANZARO, a city in the kingdom of Naples, the capital of Calabria Ulterior, with a bishop's see. It is the usual residence of the governor of the province, and is seated on a mountain, in E. Long. 18. 20. N. Lat. 38. 58.

CATAPHONICS, the science which considers the properties of reflected sounds. See ACOUSTICS.

CATAPHORA, in medicine, the same as COMA.

CATAPHRACTA, (from κατα, and φρασσω, *I fortify* or *arm*), in the ancient military art, a piece of heavy defensive armour, formed of cloth or leather, fortified with iron scales or links, wherewith sometimes only the breast, sometimes the whole body, and sometimes the horse too, was covered. It was in use among the Sarmatians, Persians, and other Barbarians. The Romans also adopted it early for their foot; and, according to Vegetius, kept to it till the time of Gratian, when the military discipline growing remiss, and field exercises and labour discontinued, the Roman foot thought the cataphracta as well as the helmet too great a load to bear, and therefore threw both by, choosing rather to march against the enemy bare-breasted; by which, in the war with the Goths, multitudes were destroyed.



*CATAPHRACTÆ Naves*, ships armed and covered in fight, so that they could not be easily damaged by the enemy. They were covered over with boards or planks, on which the soldiers were placed to defend them; the rowers sitting underneath, thus screened from the enemy's weapons.

CATAPHRACTUS, denotes a thing defended or covered on all sides with armour.

CATAPHRACTUS, or *Cataphractarius*, more particularly denotes a horseman, or even horse, armed with a cataphracta. The *cataphracta equites* were a sort of cuirassiers, not only fortified with armour themselves, but having their horses guarded with solid plates of brass or other metals, usually lined with skins and wrought into plumes or other forms. Their use was to bear down all before them, to break in upon the enemies ranks, and spread terror and havock wherever they came, as being themselves invulnerable and secure from danger. But their disadvantage was their unwieldiness, by which, if once unhorsed or on the ground, they were unable to rise, and thus fell a prey to the enemy.

CATAPHRYGIANS, a sect in the second century, so called as being of the country of Phrygia. They were orthodox in every thing, setting aside this, that they took Montanus for a prophet, and Priscilla and Maximilla for true prophetesses, to be consulted in every thing relating to religion; as supposing the Holy Spirit had abandoned the church. See MONTANIST.

CATAPLASMA, a poultice; from καταπλασσω, *illino*, to spread like a plaster. Cataplasms take their name sometimes from the part to which they are applied, or effects they produce; so are called *anacollema*, *frontale*, *epicarpium*, *epispasticum*, *vesicatorium*; and when mustard is an ingredient, they are called *sinapisms*.

These kind of applications are softer and more easy than plasters or ointments. They are formed of some vegetable substances, and applied of such a consistence as neither to adhere nor run: they are also more useful when the intention is effected by the perpetuity of the heat or cold which they contain, for they retain them longer than any other kind of composition.

When designed to *relax*, or to promote suppuration, they should be applied warm. Their warmth, moisture, and the obstruction they give to perspiration, is the method of their answering that end. The proper heat, when applied warm, is no more than to promote a kindly pleasant sensation; for great heat prevents the design for which they are used. They should be renewed as often as they cool. For relaxing

and

and ſuppurating, none excel the white-bread poultice, made with the crumb of an old loaf, a ſufficient quantity of milk to boil the bread in until it is ſoft, and a little oil; which laſt ingredient, beſides preventing the poultice from drying and ſticking to the ſkin, alſo retains the heat longer than the bread and milk alone would do. To preſerve the heat longer, the poultice, when applied, may be covered with a ſtrong ox's bladder.

When deſigned to *repel*, they ſhould be applied cold, and ought to be renewed as oft as they become warm. A proper compoſition for this end is a mixture of oatmeal and vinegar.

CATAPULTA, in antiquity, a military engine contrived for the throwing of arrows, darts, and ſtones upon the enemy.—Some of theſe engines were of ſuch force that they would throw ſtones of an hundred weight. Joſephus takes notice of the ſurpriſing effects of theſe engines, and ſays, that the ſtones thrown out of them beat down the battlements, knocked off the angles of the towers, and would level a whole file of men from one end to the other, was the phalanx ever ſo deep. This was called the

*Battering* CATAPULTA, and is repreſented on Plate CXXVII. This catapulta is ſuppoſed to carry a ſtone, *&c.* of an hundred weight, and therefore a deſcription of it will be ſufficient to explain the doctrine of all the reſt; for ſuch as threw ſtones of 500 and upwards were conſtructed on the ſame principles.

The baſe is compoſed of two large beams 2, 3. The length of thoſe beams is fifteen diameters of the bore of the capitals 9. At the two extremities of each beam, two double mortiſes are cut to receive the eight tenons of two croſs beams, each of them four of the diameters in length. In the centre of each of the beams of the baſe, and near two-thirds of their length, a hole, perfectly round, and 16 inches in diameter, ſhould be bored: theſe holes muſt be exactly oppoſite to each other, and ſhould increaſe gradually to the inſide of the beams, ſo that each of them, being 16 inches on the outſide towards the capitals 9, ſhould be 17¼ at the opening on the inſide, and the edges carefully rounded off. The capitals 9 are, in a manner, the ſoul of the machine, and ſerve to twiſt and ſtrain the cordage, which forms its principle or power of motion.

The capitals are either of caſt braſs or iron; each conſiſting of a wheel with teeth, C 10, of 2¼ inches thick. The hollow or bore of theſe wheels ſhould be 11¼ inches in diameter, perfectly round, and the edges ſmoothed down. As the friction would be too great, if the capitals rubbed againſt the beams, by the extreme ſtraining of the cordage, which draws them towards theſe beams, that inconvenience is remedied by the means of eight friction-wheels, or cylinders of braſs, about the 13th of an inch in diameter, and an inch and one-ſixth in length, placed circularly, and turning upon axes, as repreſented at D 13, B 12. One of theſe friction-wheels at large with its ſcrew, by which it is faſtened into the beam, is repreſented at A.

Upon this number of cylindrical wheels the capitals 9 muſt be placed in the beams, 2, 3, ſo that the cylinders do not extend to the teeth of the wheels, which muſt receive a ſtrong pinion 14. By the means of this pinion the wheel of the capital is made to turn for ſtraining the cordage with the key 15. The capital wheel has a ſtrong catch 16, and another of the ſame kind may be added to prevent any thing from giving way through the extreme and violent force of the ſtrained cordage.

The capital-piece of the machine is a nut or croſs-pin of iron, 17, ſeen at C, and hammered cold into its form. It divides the bore of the capitals exactly in two equal parts, and fixed in groves about an inch deep. This piece, or nut, ought to be about two inches and one-third thick at the top 18, as repreſented in the ſection at B; and rounded off and poliſhed as much as poſſible, that the cords folded over it may not be hurt or cut by the roughneſs or edges of the iron. Its height ought to be eight inches, decreaſing gradually in thickneſs to the bottom, where it ought to be only one inch. It muſt be very exactly inſerted in the capitals.

After placing the two capitals in the holes of the two beams in a right line with each other, and fixing the two croſs diametrical nuts or pieces over which the cordage is to wind, one end of the cord is reeved through a hole in one of the capitals in the baſe, and made faſt to a nail within-ſide of the beam. The other ſide of the cord is then carried through the hole in the oppoſite beam and capital, and ſo wound over the croſs pieces of iron in the centre of the two capitals, till they are full, the cordage forming a large ſkain. The tenſion or ſtraining of the cordage ought to be exactly equal, that is, the ſeveral foldings of the cord over the capital-pieces ſhould be equally ſtrained, and ſo near each other as not to leave the leaſt ſpace between them. As ſoon as the firſt folding or ſkain of cord has filled up one whole ſpace or breadth of the capital pieces, another muſt be carried over it; and ſo on, always equally ſtraining the end till no more will paſs through the capitals, and the ſkain of cordage entirely fills them, obſerving to rub it from time to time with ſoap.

At three or four inches behind the cordage, thus wound over the capital pieces, two very ſtrong upright beams 21 are raiſed: theſe are poſts of oak 14 inches thick, croſſed over at top by another of the ſame ſolidity. The height of the upright beams is 7¼ diameters; each ſupported behind with very ſtrong props 25, fixed at bottom in the extremities of the baſe 2, 3. The croſs beam 24 is ſupported in the ſame manner by a prop in the centre.

The tree, arm, or ſtylus 22, ſhould be of ſound aſh. Its length is from 15 to 16 diameters of the bore of the capitals. The end at the bottom, or that fixed in the middle of the ſkain, is 10 inches thick, and 14 broad. To ſtrengthen the arm or tree, it ſhould be wrapped round with a cloth dipped in ſtrong glue like the tree of a ſaddle, and bound very hard with waxed thread of the ſixth of an inch in diameter from the large end at bottom, almoſt to the top, as repreſented in the figure.

At the top of the arm, juſt under the iron-hand or receiver 27, a ſtrong card is faſtened, with two loops twiſted one within another, for the greater ſtrength. Into theſe two loops the hook of a braſs pulley 28 is put. The cord 29 is then reeved through the pulley, and faſtened to the roll 30. The cock or trigger 31, which

which serves as a stay, is then brought to it, and made fast by its hook to the extremity of the hand 27, in which the body to be discharged is placed. The pulley at the neck of the arm is then unhooked; and when the trigger is to let it off, a stroke must be given upon it with an iron bar or crow of about an inch in diameter; on which the arm flies up with a force almost equal to that of a modern mortar. The cushion or stomacher 23, placed exactly in the middle of the cross-beam 24, should be covered with tanned ox-hide, and stuffed with hair, the arm striking against it with inconceivable force. It is to be observed, that the tree or arm 22 describes an angle of 90 degrees, beginning at the cock, and ending at the stomacher or cushion.

*Catapulta for Arrows, Spears, or Darts.* Some of the spears, &c. thrown by these engines are said to have been 18 feet long, and to have been thrown with such velocity as to take fire in their course.

Fig. 2. ABCD is the frame that holds the darts or arrows, which may be of different numbers, and placed in different directions. EF is a large and strong iron spring, which is bent by a rope that goes over three pullies I, K, L; and is drawn by one or several men; this rope may be fastened to a pin at M. The rope, therefore, being set at liberty, the spring must strike the darts with great violence, and send them, with surprizing velocity to a great distance. This instrument differs in some particulars from the description we have of that of the ancients; principally in the throwing of several darts at the same time, one only being thrown by theirs.

CATARACT, in hydrography, a precipice in the channel of a river, caused by rocks or other obstacles, stopping the course of the stream from whence the water falls with a greater noise and impetuosity. The word comes from καταρρασσω, "I tumble down with violence;" compounded of κατα, "down," and ρασσω, *dejicio*, "I throw down."—such are the cataracts of the Nile, the Danube, Rhine, &c. In that of Niagara, the perpendicular fall of the water is 137 feet: and in that of Pistil Rhaiadr, in North Wales, the fall of water is near 240 feet from the mountain to the lower pool.

Strabo calls that a cataract which we call a *cascade;* and what we call a *cataract,* the ancients usually called a *catadupa.* Herminius has an express dissertation, "De admirandis mundi Cataractis supra et subterraneis;" where he uses the word in a new sense; signifying by cataract, any violent motion of the elements.

Cataract, in medicine and surgery, a disorder of the humours of the eye, by which the pupilla, that ought to appear transparent and black, looks opaque, blue, grey, brown, &c. by which vision is variously impeded, or totally destroyed. See Surgery.

CATARO, a town of Dalmatia, and capital of the territory of the same name, with a strong castle, and a bishop's see. It is subject to Venice, and seated on a gulph of the same name. E. Long. 19. 19. N. Lat. 42. 25.

CATARACTES, in ornithology, the trivial name of a species of Laxus.

CATARRH, in medicine a distillation or defluxion, from the head upon the mouth and aspera arteria, and through them upon the lungs. See (the *Index* subjoined to) Medicine.



CATASTASIS, in poetry, the third part of the ancient drama; being that wherein the intrigue, or action, set forth in the epitasis, is supported, carried on, and heightened, till it be ripe for the unravelling in the catastrophe. Scaliger defines it, the full growth of the fable, while things are at a stand in that confusion to which the poet has brought them.

CATASTROPHE, in dramatic poetry, the fourth and last part in the ancient drama; or that immediately succeeding the catastasis; or, according to others, the third only; the whole drama being divided into protasis, epitasis, and catastrophe, or in the terms of Aristotle, prologue, epilogue, and exode.

The catastrophe clears up every thing, and is nothing else but the discovery or winding up of the plot. It has its peculiar place: for it ought entirely to be contained, not only in the last act, but in the very conclusion of it; and when the plot is finished, the play should be so also. The catastrophe ought to turn upon a single point, or start up on a sudden.

The great art in the catastrophe is, that the clearing up of all difficulties may appear wonderful, and yet easy, simple, and natural.

It is a very preposterous artifice of some writers to show the catastrophe in the very title of the play. Mr Dryden thinks that a catastrophe resulting from a mere change in the sentiments and resolutions of a person, without any other machinery, may be so managed as to be exceedingly beautiful.

It is a dispute among the critics, whether the catastrophe should always fall out favourably on the side of virtue or not. The reasons on the negative side seem the strongest. Aristotle prefers a shocking catastrophe to a happy one—The catastrophe is either simple or complex. The first is that in which there is no change in the state of the principal persons, nor any discovery or unravelling, the plot being only a mere passage out of agitation into quiet repose. In the second, the principal persons undergo a change of fortune, in the manner already defined.

CATCH, in the musical sense of the word, a fugue in the unison, wherein, to humour some conceit in the words, the melody is broken, and the sense interrupted in one part, and caught again or supported by another; as in the catch in Shakespeare's play of the Twelfth-night, where there is a catch sung by three persons, in which the humour is, that each who sings, calls, and is called *knave* in turn: Or, as defined by Mr Jackson, "a catch is a piece for three or more voices, one of which leads, and the other follow in the same notes. It must be so contrived, that rests (which are made for that purpose) in the music of one line be filled up with a word or two from another line; these form a cross purpose, or catch, from whence the name."

*Catch-Fly,* in botany. See Lychnis.

*Catch-Pole,* (quasi one that *catches* by the *pole),* a term used, by way of reproach, for the bailiff's follower or assistant.

*Catch-Word,* among printers, that placed at the bottom of each page, being always the first word of the following page.

CATECHESIS, in a general sense, denotes an instruction given any person in the first rudiments of an art or science; but more particularly of the Christian religion. In the ancient church, catechesis was an instruction given *viva voce*, either to children, or adult heathens, preparatory to their receiving of baptism. In this sense, *catechesis* stands contradistinguished from *mystagogica*, which were a higher part of instruction given to those already initiated, and containing the mysteries of faith. Those who give such instructions are called *catechists*; and those who receive them, *catechumens*.

CATECHETIC, or CATECHETICAL, something that relates to oral instruction in the rudiments of Christianity.—Catechetic schools were buildings appointed for the office of the catechist, adjoining to the church, and called *catechumena*: such was that in which Origen and many other famous men read catechetical lectures at Alexandria. See CATECHUMEN.

CATECHISM, in its primary sense, an instruction, or institution, in the principles of the Christian religion, delivered *viva voce*, and so as to require frequent repetitions, from the disciple or hearer, of what has been said. The word is formed from κατηχεω, a compound of κατα and ηχος, q. d. *circumsono*, alluding to the noise or din made in this sort of exercise, or to the zeal and earnestness wherewith things are to be inculcated over and over on the learners.—Anciently the candidates for baptism were only to be instructed in the secrets of their religion by tradition *viva voce*, without writing; as had also been the case among the Egyptian priests, and the British and Gaulish druids, who only communicated the mysteries of their theology by word of mouth.

CATECHISM is more frequently used in modern times for an elementary book, wherein the principal articles of religion are summarily delivered in the way of question and answer.

CATECHIST, κατηχιστης, *catecheta*, he that catechises, *i. e.* he that instructs novices in the principles of religion.

CATECHIST more particularly denotes a person appointed by the church to instruct those intended for baptism, by word of mouth, in the fundamental articles of the Christian faith—The catechist of churches were ministers usually distinct from the bishops and presbyters, and had their auditories or *catechumena* apart. Their business was to instruct the catechumens, and prepare them for the reception of baptism. But the catechists did not constitute any distinct order of the clergy, but were chosen out of any other order. The bishop himself sometimes performed the office; at other times presbyters, or even readers or deacons, were the catechists. Origen seems to have had no higher degree in the church than reader, when he was made catechist at Alexandria, being only 18 years of age, and consequently incapable of the deaconship.

CATECHU, in the materia medica, the name of a troche consisting of Japan earth and gum arabic, each two ounces, and of sugar of roses sixteen ounces, beat together with a little water. It is recommended as a mild restringent, &c.

CATECHUMEN, a candidate for baptism, or one who prepares himself for the receiving thereof.

The catechumens, in church-history, were the lowest order of Christians in the primitive church. They had some title to the common name of Christian, being a degree above pagans and heretics, though not consummated by baptism. They were admitted to the state of catechumens by the imposition of hands, and the sign of the cross. The children of believing parents were admitted catechumens, as soon as ever they were capable of instruction: but at what age those of heathen parents might be admitted, is not so clear. As to the time of their continuance in this state, there were no general rules fixed about it; but the practice varied according to the difference of times and places, and the readiness and proficiency of the catechumens themselves.



There were four orders or degrees of catechumens; the first were those instructed privately without the church, and kept at a distance for some time from the privilege of entering the church, to make them the more eager and desirous of it. The next degree were the *audientes*, so called from their being admitted to hear sermons, and the scriptures read in the church, but were not allowed to partake of the prayers. The third sort of catechumens were the *genu-flectentes*, so called because they received imposition of hands kneeling. The fourth order was the *competentes & electi*, denoting the immediate candidates for baptism, or such as were appointed to be baptised the next approaching festival; before which, strict examination was made into their proficiency under the several stages of catechetical exercises.

After examination, they were exercised for twenty days together, and were obliged to fasting and confession: some days before baptism they went veiled; and it was customary to touch their ears, saying, *Ephatha*, i. e. Be opened; as also to anoint their eyes with clay; both ceremonies being in imitation of our Saviour's practice, and intended to shadow out to the catechumens their condition both before and after their admission into the Christian church.

CATEGORICAL, in a general sense, is applied to those things ranged under a CATEGORY.

CATEGORICAL also imports a thing to be absolute, and not relative: in which sense it stands opposed to *hypothetical*. We say, a *categorical* proposition, a *categorical* syllogism, *&c.*

A *categorical* answer denotes an express and pertinent answer made to any question or objection proposed.

CATEGORY, in logic, a series or order of all the predicates or attributes contained under any genus.

The school-philosophers distribute all the objects of our thoughts and ideas into certain *genera* or classes, not so much, say they, to learn what they do not know, as to communicate a distinct notion of what they do know; and these classes the Greeks called *categories*, and the Latins *predicaments*.

Aristotle made ten categories, viz. quantity, quality, relation, action, passion, time, place, situation, and habit, which are usually expressed by the following technical distich:

*Arbor, sex, servos, adore refrigerat, ustos,*
*Rure cras stabo, nec tunicatus ero.*

CATEK. See BENGAL, n° 15.

CATENARIA, in the higher geometry, the name of a curve-line formed by a rope hanging freely from two points of suspension, whether the points be horizontal or not. See FLUXIONS.

CATERPILLAR, in zoology, the name of all winged insects when in their reptile or worm-state. See ERUCA.

*Method of Destroying* CATERPILLARS *on Trees.*— Take a chaffing dish with lighted charcoal, and placing it under the branches that are loaded with caterpillars, throw some pinches of brimstone upon the coals. The vapour of the sulphur, which is mortal to these insects, will not only destroy all that are on the tree, but prevent it from being infested with them afterwards. A pound of sulphur will clear as many trees as grow on several acres. This method has been successfully tried in France. In the *Journal Oeconomique*, the following is said to be infallible against the catterpillars feeding on cabbage, and perhaps may be equally serviceable against those that infest other vegetables. Sow with hemp all the borders of the ground where you mean to plant your cabbage; and, although the neighbourhood is infected with caterpillars, the space inclosed by the hemp will be perfectly free, not one of the vermin will approach it.

CATERPILLAR-*Eaters*, a name given by some authors to a species of worms bred in the body of the caterpillar, and which eat its flesh; these are owing to a certain kind of fly that lodges her eggs in the body of this animal, and they, after their proper changes, become flies like their parents.

Mr Reaumur has given us, in his history of insects, some very curious particulars in regard to these little worms. Every one of them, he observes, spins itself a very beautiful case of a cylindric figure, made of a very strong sort of silk; these are the cases in which this animal spends its state of chrysalis; and they have a mark by which they may be known from all other animal productions of this kind, which is, that they have always a broad stripe or band surrounding their middle, which is black when the rest of the case is white, and white when that is black. Mr Reaumur has had the pains and patience to find out the reason of this singularity, which is this: the whole shell is spun of a silk produced out of the creature's body; this at first runs all white, and towards the end of the spinning turns black. The outside of the case must necessarily be formed first, as the creature works from within; consequently this is truly white all over, but it is transparent, and shows the last spun or black silk through it. It might be supposed that the whole inside of the shell should be black; but this is not the case: the whole is fashioned before this black silk comes; and this is employed by the creature, not to line the whole, but to fortify certain parts only; and therefore is all applied either to the middle, or to the two ends omitting the middle; and so gives either a black band in the middle, or a blackness at both ends, leaving the white in the middle to appear. It is not unfrequent to find a sort of small cases, lying about garden walks, which move of themselves; when these are opened, they are found to contain a small living worm. This is one of the species of these caterpillar-eaters; which as soon as it comes out of the body of that animal, spins itself a case for its transformation long before that happens, and lives in it without food till that change comes on; and it becomes a fly like that to which it owed its birth.



CATERVA, in ancient military writers, a term used in speaking of the Gaulish or Celtiberian armies, denoting a body of 6000 armed men. The word *caterva*, or *catervarius*, is also frequently used by ancient writers to denote a party or corps of soldiers in disorder or disarray: by which it stands distinguished from cohort or turma, which were in good order.

CATESBÆA, the LILY-THORN: A genus of the monogynia order, belonging to the tetrandria class of plants; and in the natural method ranking under the 28th order, *Luridæ*. The corolla is monopetalous, funnel-shaped, very long above the receptacle of the fruit; the stamina are within its throat; the fruit a polyspermous berry. There is only one species, viz. the spinosa, which was discovered in the island of Providence by Mr Catesby, who gathered the seeds, and brought them to England. It rises to the height of ten or twelve feet, and is covered with a pale russet bark; the branches come out alternately, and are garnished with small leaves resembling those of the box-tree, coming out in clusters all round the branches at certain distances; the flowers hang downward, and come out from the side of the branches: they are tubulous and near six inches long, very narrow at their base, but widening upwards towards the top, where it is divided into four parts which spread open, and are reflexed backward. They are of a dull yellow colour. This plant is propagated by seeds which must be procured from the country where it grows. The seeds must be sown on a hot-bed, and are to be treated in the same manner as other tender exotics.

CATHÆRETICS, in pharmacy, medicines of a caustic nature, serving to eat off proud flesh.

CATHARINE, *Knights of St* CATHARINE *of Mount Sinai*, an ancient military order, erected for the assistance and protection of pilgrims going to pay their devotion to the body of St Catharine, a virgin of Alexandria, distinguished for her learning, and said to have suffered martyrdom under Maximin. The body of the martyr having been discovered on mount Sinai, caused a great concourse of pilgrims; and travelling being very dangerous, by reason of the Arabs, an order of knighthood was erected in 1063, on the model of that of the holy sepulchre, and under the patronage of St Catharine: the knights of which obliged themselves by oath to guard the body of the saint, keep the roads secure, observe the rules of St Basil, and obey their grand master. Their habit was white, and on it were represented the instruments of martyrdom whereby the saint had suffered; viz. a half-wheel armed with spikes, and traversed with a sword stained with blood.

CATHARINE, *Fraternity of St Catharine at Sienna*, a sort of religious society instituted in that city, in honour of St Catharine, a saint famous for her revelations, and for her marriage with Jesus Christ, whose wedding ring is still preserved as a valuable relic. This fraternity yearly endows a certain number of destitute virgins, and has the privilege of redeeming annually two criminals condemned for murder, and the same number of debtors, by paying their debts.

CATHARTICS, in medicine, remedies which pro-

 mote

mote evacuation by stool. See Materia Medica.

CATHECU, in botany. See Areca.

CATHEDRA, in a general sense, a chair.—The word is more particularly used for a professor's chair, and a preacher's pulpit.

Cathedra is also used for the bishop's see, or throne, in a church.

CATHEDRAL, a church wherein is a bishop's see or seat: See Church, and Bishop. The word comes from the Greek καθεδρα, "chair," of καθεζομαι, *sedeo*, "I sit." The denomination *cathedral* seems to have taken its rise from the manner of sitting in the ancient churches, or assemblies of primitive christians: in these, the council, i. e. the elders and priests, was called *Presbyterium*; at their head was the bishop, who held the place of chairman, *Cathedralis*, or *Cathedraticus*; and the presbyters, who sat on either side, were also called by the ancient fathers, *Assessores Episcoporum*. The episcopal authority did not reside in the bishop alone; but in all the presbyters, whereof the bishop was president. A *cathedral*, therefore, originally, was different from what it is now; the Christians, till the time of Constantine, having no liberty to build any temple: by their churches they only meant their assemblies; and by *cathedrals*, nothing more than consistories.

CATHERINE Parr. See Parr.

Catherine I. *Empress of Russia*, a most extraordinary personage, whose history deserves to be given in detail. She was the natural daughter of a country girl; and was born at Ringen, a small village upon the lake Virtcherve, near Dorpt in Livonia. The year of her birth is uncertain; but, according to her own account, she came into the world on the 5th of April, 1687. Her original name was Martha, which she changed for Catherine when she embraced the Greek religion. Count Rosen, a lieutenant-colonel in the Swedish service, who owned the village of Ringen, supported, according to the custom of the country, both the mother and the child: and was, for that reason, supposed by many persons to have been her father. She lost her mother when she was but three years old; and, as count Rosen died about the same time, she was left in so destitute a situation, that the parish-clerk of the village received her into his house. Soon afterwards Gluck, Lutheran minister of Marienburgh, happening, in a journey through those parts, to see the foundling, took her under his protection, brought her up in his family, and employed her in attending his children. In 1701, and about the 14th year of her age, she espoused a dragoon of the Swedish garrison of Marienburgh. Many different accounts are given of this transaction: one author of great credit affirms that the bride and bridegroom remained together eight days after their marriage; another, of no less authority, asserts, on the contrary, that on the morning of their nuptials her husband being sent with a detachment for Riga, the marriage was never consummated. Thus much is certain, that the dragoon was absent when Marienburgh surrendered to the Russians; and Catherine, who was reserved for a higher fortune, never saw him more.

General Bauer, upon the taking of Marienburgh, saw Catherine among the prisoners; and, being smitten with her youth and beauty, took her to his house, where she superintended his domestic affairs, and was supposed to be his mistress. Soon afterwards she was removed into the family of prince Menzikof, who was no less struck with the attractions of the fair captive. With him she lived until 1704; when, in the 17th year of her age, she became the mistress of Peter the Great, and won so much upon his affections, that he espoused her on the 29th of May 1711. The ceremony was secretly performed at Jawerof in Poland, in the presence of General Bruce; and on the 20th of February, 1712, it was publicly solemnized with great pomp at Petersburgh.



Catherine, by the most unwearied assiduity and unremitted attention, by the softness and complacency of her disposition, but above all by an extraordinary liveliness and gaiety of temper, acquired a wonderful ascendency over the mind of Peter. The latter was subject to occasional horrors, which at times rendered him gloomy and suspicious, and raised his passions to such an height as to produce a temporary madness. In these dreadful moments Catherine was the only person who durst venture to approach him; and such was the kind of fascination she had acquired over his senses, that her presence had an instantaneous effect, and the first sound of her voice composed his mind and calmed his agonies. From these circumstances she seemed necessary, not only to his comfort, but even to his very existence, she became his inseparable companion on his journeys into foreign countries, and even in all his military expeditions.

The peace of Pruth, by which the Russian army was rescued from certain destruction, has been wholly attributed to Catherine, though she was little more than an instrument in procuring the consent of Peter. The latter, in his campaign of 1711 against the Turks, having imprudently led his troops into a disadvantageous situation, took the desperate resolution of cutting his way through the Turkish army in the night. With this resolution he retired to his tent in an agony of despair, and gave positive orders that no one should be admitted under pain of death. In this important juncture the principal officers and the vice-chancellor Shaffirof, assembled in the presence of Catherine, and drew up certain preliminaries in order to obtain a truce from the grand vizir. In consequence of this determination, plenipotentiaries were immediately dispatched without the knowledge of Peter, to the grand vizir, and a peace obtained upon more reasonable conditions than could have been expected. With these conditions Catherine, notwithstanding the orders issued by Peter, entered his tent, and prevailed upon him to sign them. Catherine, by her conduct on this occasion, acquired great popularity; and the emperor particularly specifies her behaviour at Pruth as one of the reasons which induced him to crown her publicly at Moscow with his own hand. This ceremony was performed in 1724; and although designed by Peter only as a proof his affection, was the principal cause of her subsequent elevation.

Her influence continued undiminished until a short time before the death of the emperor, when some circumstances happened which occasioned such a coolness between them as would probably have ended in a total rupture, if his death had not fortunately intervened. The

Catherine. original cause of this misunderstanding arose from the following discovery of a secret connection between Catherine and her first chamberlain, whose name was Mons. The emperor, who was suspicious of this connection, quitted Petersburgh under pretence of removing to a villa for a few days, but privately returned to his winter palace in the capital. From thence he occasionally sent one of his confidential pages with a complimentary message to the empress, as if he had been in the country, and with secret orders to observe her motions. From the page's information the emperor on the third night, surprised Catherine in an arbour of the garden with her favourite Mons; while his sister Madame Balke, who was first lady of the bed-chamber to the empress, was in company with a page, upon the watch without the arbour.

Peter, whose violent temper was inflamed by this discovery, struck Catherine with his cane, as well as the page, who endeavoured to prevent him from entering the arbour, and then retired without uttering a single word either to Mons or his sister. A few days after this transaction these persons were taken into custody, and Mons was carried to the winter palace, where no one had admission to him but Peter, who himself brought him his provisions. A report was at the same time circulated, that they were imprisoned for having received bribes, and making their influence over the empress subservient to their own mercenary views. Mons being examined by Peter, in the presence of major-general Uschakof, and threatened with the torture, confessed the corruption which was laid to his charge. He was beheaded; his sister received five strokes of the knout, and was banished into Siberia; two of her sons, who were chamberlains, were also degraded, and sent as common soldiers among the Russian troops in Persia. On the day subsequent to the execution of the sentence, Peter conveyed Catherine in an open carriage under the gallows, to which was nailed the head of Mons. The empress, without changing colour at this dreadful sight, exclaimed "What a pity it is that there is so much corruption among courtiers!"

This event happened in the latter end of the year 1724; and as it was soon followed by Peter's death, and Catherine upon her accession recalled Madame Balke, it has been suspected that she shortened the days of her husband by poison. But notwithstanding the critical situation for Catherine in which he died, and her subsequent elevation, this charge is totally destitute of the least shadow of proof: for the circumstances of Peter's disorder were too well known, and the peculiar symptoms of his last illness sufficiently account for his death, without the necessity of recurring to poison.

While Peter was yet lying in the agonies of death, several opposite parties were caballing to dispose of the crown. At a considerable meeting of many among the principal nobility, it was secretly determined, on the moment of his dissolution, to arrest Catherine, and to place Peter Alexievitch upon the throne. Bassevitz, apprized of this resolution, repaired in person to the empress, although it was already night. "My grief and consternation," replied Catherine, "render me incapable of acting myself: do you and prince Menzikof consult together, and I will embrace the measures which you shall approve in my name." Bassevitz, finding Menzikof asleep, awakened and informed him of the pressing danger which threatened the empress and her party. As no time remained for long deliberation, the prince instantly seized the treasure, secured the fortress, gained the officers of the guards by bribes and promises, also a few of the nobility, and the principal clergy. These partizans being convened in the palace, Catherine made her appearance: she claimed the throne in right of her coronation at Moscow; she exposed the ill effects of a minority; and promised, that, "so far from depriving the great-duke of the crown, she would receive it only as a sacred deposit, to be restored to him when she should be united, in another world, to an adored husband, whom she was now upon the point of losing."

The pathetic manner with which she uttered this address, and the tears which accompanied it, added to the previous distribution of large sums of money and jewels, produced the desired effect: at the close of this meeting the remainder of the night was employed in making the necessary preparations to insure her accession in case of the emperor's death.

Peter at length expired in the morning of the 28th of January 1725. This event being made known, the senate, the generals, the principal nobility and clergy, hastened to the palace to proclaim the new sovereign. The adherents of the great duke seemed secure of success, and the friends of Catherine were avoided as persons doomed to destruction. At this juncture Bassevitz whispered one of the opposite party, "The empress is mistress of the treasure and the fortress; she has gained over the guards and the synod, and many of the chief nobility; even here she has more followers than you imagine; advise therefore your friends to make no opposition as they value their heads." This information being rapidly circulated, Bassevitz gave the appointed signal, and the two regiments of guards, who had been gained by a largess to declare for Catherine, and had already surrounded the palace, beat to arms. "Who has dared (exclaimed prince Repnin, the commander in chief) to order out the troops without my knowledge?" "I, (returned general Butterlin), without pretending to dispute your authority, in obedience to the commands of my most gracious mistress." This short reply was followed by a dead silence. In this moment of suspence an anxiety Menzikof entered, preceding Catherine, supported by the duke of Holstein. She attempted to speak, but was prevented by sighs and tears from giving utterance to her words: at length, recovering herself, "I come (she said), notwithstanding the grief which now overwhelms me, to assure you, that, submissive to the will of my departed husband, whose memory will be ever dear to me, I am ready to devote my days to the painful occupations of government until Providence shall summon me to follow him." Then, after a short pause, she artfully added, "If the great-duke will profit by my instructions, perhaps I shall have the consolation, during my wretched widowhood, of forming for you an emperor worthy of the blood and the name of him whom you have now irretrievably lost." "As this crisis (replied Menzikof) is a moment of such importance to the good of the empire, and requires the most mature deliberations, your majesty, Catherine. jesty will permit us to confer, without restraint, that this whole affair may be transacted without reproach, as well in the opinion of the present age as in that of posterity." "Acting as I do (answered Catherine), more for the public good than for my own advantage, I am not afraid to submit all my concerns to the judgment of such an enlightened assembly: you have not only my permission to confer with freedom; but I lay my commands upon you all to deliberate maturely on this important subject, and I promise to adopt whatever may be the result of your decisions." At the conclusion of these words the assembly retired into another apartment, and the doors were locked.

It was previously settled by Menzikof and his party that Catherine should be empress; and the guards, who surrounded the palace with drums beating and colours flying, effectually vanquished all opposition. The only circumstance, therefore, which remained, was to give a just colour to her title, by persuading the assembly that Peter intended to have named her his successor. For this purpose Menzikof demanded of that emperor's secretary, whether his late master had left any written declaration of his intentions? The secretary replied, "That a little before his last journey to Moscow he had destroyed a will; and that he had frequently expressed his design of making another, but had always been prevented by the reflection, that if he thought his people, whom he had raised from a state of barbarism to an high degree of power and glory, could be ungrateful, he would not expose his final inclinations to the insult of a refusal; and that if they recollected what they owed to his labours, they would regulate their conduct by his intentions, which he had disclosed with more solemnity than could be manifested by any writings." An altercation now began in the assembly; and some of the nobles having the courage to oppose the accession of Catherine, Theophanes archbishop of Plescof called to their recollection the oath which they had all taken in 1722 to acknowledge the successor appointed by Peter; and added, that the sentiments of that emperor delivered by the secretary were in effect an appointment of Catherine. The opposite party, however, denied these sentiments to be so clear as the secretary chose to insinuate; and insisted, that as their late monarch had failed to nominate his heir, the election of the new sovereign should revert to the state. Upon this the archbishop farther testified, that the evening before the coronation of the empress at Moscow, Peter had declared in the house of an English merchant, that he should place the crown upon her head with no other view than to leave her mistress of the empire after his decease. This attestation being confirmed by many persons present, Menzikof cried out, "What need have we of any testament! A refusal to conform to the inclination of our great sovereign, thus authenticated, would be both unjust and criminal. Long live the empress Catherine!" These words being instantaneously repeated by the greatest part of those who were present, Menzikof, saluting Catherine by the title of empress, paid his first obeisance by kissing her hand; and his example was followed by the whole assembly. She next presented herself at the window to the guards, and to the people, who shouted acclamations of "Long live Catherine!" while Menzikof scattered amongst them handfuls of money. Thus (says a contemporary) the empress was raised to the throne by the guards, in the same manner as the Roman emperors by the prætorian cohorts, without either the appointment of the people or of the legions. Catherine.

The reign of Catherine may be considered as the reign of Menzikof, that empress having neither inclination or abilities to direct the helm of government; and she placed the most implicit confidence in a man who had been the original author of her good fortune, and the sole instrument of her elevation to the throne.

During her short reign her life was very irregular; she was extremely averse to business; would frequently, when the weather was fine, pass whole nights in the open air; and was particularly intemperate in the use of tokay-wine. These irregularities, joined to a cancer and a dropsy, hastened her end, and she expired on the 17th of May 1727, a little more than two years after her accession to the throne, and in about the 40th year of her age.

As the deaths of sovereigns in despotic countries are seldom imputed to natural causes, that of Catherine has also been attributed to poison; as if the disorders which preyed upon her frame were not sufficient to bring her to her grave. Some assert, that she was poisoned in a glass of spirituous liquor; others, by a pear given her by general Diever. Suspicions also fell upon prince Menzikof, who, a short time before her decease, had a trifling misunderstanding with her, and who was accused of hastening her death that he might reign with still more absolute power during the minority of Peter II. But these reports deserve not the least credit, and were merely dictated by the spirit of party or by popular rumour.

Catherine was in her person under the middle-size, and in her youth delicate and well-formed, but inclined to corpulency as she advanced in years. She had a fair complexion, dark eyes, and light hair, which she was always accustomed to dye with a black colour. She could neither read nor write: her daughter Elizabeth usually signed her name for her, and particularly to her last will and testament; and count Osterman generally put her signature to the public decrees and dispatches. Her abilities have been greatly exaggerated by her panegyrists. Gordon, who had frequently seen her, seems, of all writers, to have represented her character with the greatest justness, when he says, "She was a very pretty well-look'd woman, of good sense, but not of that sublimity of wit, or rather that quickness of imagination, which some peoble have believed. The great reason why the czar was so fond of her, was her exceeding good temper; she never was seen peevish, or out of humour; obliging and civil to all, and never forgetful of her former condition; withal, mighty grateful." Catherine maintained the pomp of majesty with an air of ease and grandeur united; and Peter used frequently to express his admiration at the propriety with which she supported her high station, without forgetting that she was not born to that dignity.

The following anecdotes will prove that she bore her elevation meekly; and, as Gordon asserts, was never forgetful of her former condition. When Wurmb, who had been tutor to Gluck's children at the

the time that Catherine was a domestic in that clergyman's family, presented himself before her after her marriage with Peter had been publicly solemnized, she recollected and addressed him with great complacency, "What, thou good man, art thou still alive! I will provide for thee." And she accordingly settled upon him a pension. She was no less attentive to the family of her benefactor Gluck, who died a prisoner at Moscow: she pensioned his widow; made his son a page; portioned the two eldest daughters; and advanced the youngest to be one of her maids of honour. If we may believe Weber, she frequently enquired after her first husband; and, when she lived with prince Menzikof, used secretly to send him small sums of money, until, in 1705, he was killed in a skirmish with the enemy.

But the most noble part of her character was her peculiar humanity and compassion for the unfortunate. Motraye has paid an handsome tribute to this excellence. "She had, in some sort, the government of all his (Peter's) passions; and even saved the lives of a great many more persons than Le Fort was able to do: she inspired him with that humanity, which, in the opinion of his subjects, nature seemed to have denied him. A word from her mouth in favour of a wretch, just going to be sacrificed to his anger, would disarm him; but if he was fully resolved to satisfy that passion, he would give orders for the execution when she was absent, for fear she should plead for the victim." In a word, to use the expression of the celebrated Munich, "*Elle etoit proprement la mediatrice entre le monarque et ses sujets.*"

*Catharine, (Order of St)* in modern history, belongs to ladies of the first quality in the Russian court. It was instituted in 1714 by Catherine wife of Peter the Great, in memory of his signal escape from the Turks in 1711. The emblems of this order are a red cross, supported by a figure of St Catherine, and fastened to a scarlet string edged with silver, on which are inscribed the name of St Catherine, and the motto, *Pro fide et patria.*

CATHERLOUGH, a town of Ireland, in the county of Catherlough, and province of Leinster: seated on the river Barrow, 16 miles N. E. of Kilkenny. W. Long. 7. 1. N. Lat. 52. 45.

CATHERLOUGH, a county of Ireland, about 28 miles in length, and eight in breadth; bounded on the east by Wicklow and Wexford, on the west by Queen's county, on the north by Kildare, and on the south and south-west by Wexford. It contains 5600 houses, 42 parishes, five baronies or boroughs, and sends six members to parliament, *viz.* two for the county, two for Catherlough, and two for old Leighlen.

CATHETER, in surgery, a fistulous instrument, usually made of silver, to be introduced into the bladder, in order to search for the stone, or discharge the urine when suppressed. See SURGERY.

CATHETUS, in geometry, a line or radius falling perpendicularly on another line or surface; thus the catheti of a right-angled triangle, are the two sides that include the right angle.

*Cathetus of Incidence,* in catoptrics, a right line drawn from a point of the object, perpendicular to the reflecting line.

*Cathetus of Reflexion,* or *of the Eye,* a right line drawn from the eye perpendicular to the reflecting plane.



*Cathetus of Obliquation,* a right line drawn perpendicular to the speculum, in the point of incidence or reflexion.

CATHETUS, in architecture, a perpendicular line, supposed to pass through the middle of a cylindrical body, as a ballufter, column, *&c.*

CATHNESS. See CAITHNESS.

CATHOLIC, in a general sense, denotes any thing that is universal or general.

*Catholic Church.* The rise of heresies induced the primitive Christian church to assume to itself the appellation of *catholic,* being a characteristic to distinguish itself from all sects, who, though they had party names, sometimes sheltered themselves under the name of Christians.

The Romish church distinguishes itself now by the name of *catholic,* in opposition to all those who have separated from her communion, and whom she considers as heretics and schismatics, and herself only as the true and Christian church. In the strict sense of the word, there is no catholic church in being, that is, no universal Christian communion.

*Catholic King,* is a title which has been long hereditary to the king of Spain. Mariana pretends, that Reccarede first received this title after he had destroyed Arianism in his kingdom, and that it is found in the council of Toledo for the year 589. Vasce ascribes the origin of it to Alphonsus in 738. Some allege that it has been used only since the time of Ferdinand and Isabella. Colombiere says, it was given them on occasion of the expulsion of the Moors. The Bollandists pretend it had been borne by their predecessors the Visigoth kings of Spain; and that Alexander VI. only renewed it to Ferdinand and Isabella. Others say, that Philip de Valois first bore the title; which was given him after his death by the ecclesiastics, on account of his favouring their interests.

In some epistles of the ancient popes, the title *catholic* is given to the kings of France and of Jerusalem, as well as to several patriarchs and primates.

CATHOLICON, in pharmacy, a kind of soft purgative electuary, so called, as being supposed an universal purger of all humours.

CATILINE, (Lucius) a Roman of a noble family, who having spent his whole fortune in debauchery, formed the design of oppressing his country, destroying the senate, seizing the public treasury, setting Rome on fire, and usurping a sovereign power over his fellow-citizens. In order to succeed in this design, he drew some young noblemen into his plot; whom he prevailed upon, it is said, to drink human blood as a pledge of their union. His conspiracy, however, was discovered by the vigilance of Cicero, who was then consul. Upon which retiring from Rome, he put himself at the head of an army, with several of the conspirators, and fought with incredible valour against Petreius, lieutenant to Anthony, who was colleague with Cicero in the consulship; but was defeated and killed in battle. See *(History of)* ROME.—Sallust has given an excellent history of this conspiracy.

CATO, (Marcus Portius) the Censor, one of the greatest men among the ancients, was born at Tusculum in the year of Rome 519, about the 232d before Christ.

Cato.

Christ. He began to bear arms at 17; and, on all occasions, showed extraordinary courage. He was a man of great sobriety, and reckoned no bodily exercise unworthy of him. He had but one horse for himself and his baggage, and he looked after and dressed it himself. At his return from his campaigns, he betook himself to plough his ground; not that he was without slaves to do it, but it was his inclination. He dressed also like his slaves, sat down at the same table with them, and partook of the same fare. He did not in the mean while neglect to cultivate his mind, especially in regard to the art of speaking; and he employed his talents, which were very great, in generously pleading causes in the neighbouring cities without fee or reward. Valerius Flaccus, who had a country-seat near Cato, conceiving an esteem for him, persuaded him to come to Rome; where Cato, by his own merit, and the influence of so powerful a patron, was soon taken notice of, and promoted. He was first of all elected tribune of the soldiers for the province of Sicily. He was next made questor in Africa under Scipio. Having in this last office reproved him for his profuseness to his soldiers, the general answered, that "he did not want so exact a questor, but would make war at what expence he pleased; nor was he to give an account to the Roman people of the money he spent, but of his enterprises, and the execution of them." Cato, provoked at this answer, left Sicily, and returned to Rome.

Afterwards Cato was made prætor, when he fulfilled the duties of his office with the strictest justice. He conquered Sardinia, governed with admirable moderation, and was created consul. Being tribune in the war of Syria, he gave distinguished proofs of his valour against Antiochus the Great; and at his return stood candidate for the office of censor. But the nobles, who not only envied him as a *new* man, but dreaded his severity, set up against him seven powerful competitors. Valerius Flaccus, who had introduced him into public life, and had been his colleague in the consulship, was a ninth candidate, and these two united their interests. On this occasion Cato, far from employing soft words to the people, or giving hopes of gentleness or complaisance in the execution of his office, loudly declared from the rostra, with a threatening look and voice, "That the times required firm and vigorous magistrates to put a stop to that growing luxury which menaced the public with ruin; censors who would cut up the evil by the roots, and restore the rigour of ancient discipline." It is to the honour of the people of Rome, that, notwithstanding these terrible intimations, they preferred him to all his competitors, who courted them by promises of a mild and easy administration: the comitia also appointed his friend Valerius to be his colleague, without whom he had declared that he could not hope to compass the reformations he had in view. Cato's merit, upon the whole, was superior to that of any of the great men who stood against him. He was temperate, brave, and indefatigable; frugal of the public money, and not to be corrupted. There is scarce any talent requisite for public or private life which he had not received from nature, or acquired by industry. He was a great soldier, an able statesman, an eloquent orator, a learned historian, and very knowing in rural affairs. Yet, with all these accomplishments, he had very great faults. His ambition being poisoned with envy, disturbed both his own peace and that of the whole city as long as he lived. Though he would not take bribes, he was unmerciful and unconscionable in amassing wealth by all such means as the law did not punish.

The first act of Cato in his new office, was naming his colleague to be prince of the senate; after which the censors struck out of the list of the senators the names of seven persons; among whom was Lucius the brother of T. Flaminius. Lucius, when consul, and commanding in Gaul, had with his own hand murdered a Boian of distinction, a deserter to the Romans; and he had committed this murder purely to gratify the curiosity of his pathic, a young Carthaginian, who longing to see somebody die a violent death, had reproached the general for bringing him away from Rome just when there was going to be a fight of gladiators. Titus Flaminius, full of indignation at the dishonour done to his brother, brought the affair before the people; and insisted upon Cato's giving the reason of his proceeding. The censor related the story; and when Lucius denied the fact, put him to his oath. The accused, refusing to swear, was deemed guilty; and Cato's censure was approved. But no part of the censor's conduct seemed so cruel to the nobles and their wives as the taxes he laid upon luxury in all its branches; dress, household furniture, womens toilets, chariots, slaves, and equipage. These articles were all taxed at three *per cent.* of the real value. The people, however, in general, were pleased with his regulations; insomuch that they ordered a statue to be erected to his honour in the temple of *Health*, with an inscription that mentioned nothing of his victories or triumph, but imported only that by his wise ordinances in his censorship he had reformed the manners of the republic. Plutarch relates, that before this, upon some of Cato's friends expressing their surprise, that while many persons without merit or reputation had statues, he had none; he answered, "I had much rather it should be asked why the people have not erected a statue to Cato, than why they have." Cato was the occasion of the third Punic war. Being dispatched to Africa to terminate a difference between the Carthaginians and the king of Numidia, on his return to Rome he reported, that Carthage was grown excessively rich and populous, and he warmly exhorted the senate to destroy a city and republic, during the existence of which, Rome could never be safe. Having brought from Africa some very large figs, he showed them to the conscript fathers in one of the lappets of his gown. "The country (says he) where this fine fruit grows, is but three days voyage from Rome." We are told, that from this time he never spoke in the senate upon any subject, without concluding with these words, "I am also of opinion, that Carthage ought to be destroyed." He judged, that, for a people debauched by prosperity, nothing was more to be feared than a rival state, always powerful, and now from its misfortunes grown wise and circumspect. He held it necessary to remove all dangers that could be apprehended from *without*, when the republic had *within* so many distempers threatening her destruction.

From the censor dignified and severe, the reader will

Cato. will not perhaps be displeased to turn his view upon Cato sociable and relaxed. For we should have a false notion of him, if we imagined that nothing but a sad austerity prevailed in his speech and behaviour. On the contrary, he was extremely free; and often with his friends at table intermixed the conversation with lively discourses and witty sayings. Of these Plutarch has collected a pretty large number; we shall relate but one, and make use of Balzac's paraphrase, and the preface with which he introduces it. "The very censors, though sadness seemed to be one of the functions of their office, did not altogether lay aside raillery. They were not always bent upon severity; and the first Cato, that troublesome and intolerable honest man, ceased sometimes to be troublesome and intolerable. He had some glimpses of mirth, and some intervals of good humour. He dropped now and then some words that were not unpleasant, and you may judge of the rest by this. He had married a very handsome wife; and history tells us that she was extremely afraid of the thunder, and loved her husband well. These two passions prompted her to the same thing; she always pitched upon her husband as a sanctuary against thunder, and threw herself into his arms at the first noise she fancied she heard in the sky. Cato, who was well pleased with the storm, and very willing to be caressed, could not conceal his joy. He revealed that domestic secret to his friends; and told them one day, speaking of his wife, "that she had found out a way to make him love bad weather; and that he never was so happy as when Jupiter was angry." It is worth observing, that this was during his censorship; when he degraded the senator Manlius, who would probably have been consul the year after, only for giving a kiss to his wife in the day-time, and in the presence of his daughter.

*Oeuvres diverses*, p. 49.

Cato died in the year of Rome 604, aged 85. He wrote several works. 1. A Roman History. 2. Concerning the art of war. 3. Of rhetoric. 4. A treatise of husbandry. Of these, the last only is extant.

CATO, (Marcus Portius) commonly called Cato *Minor*, or Cato of *Utica*, was great grandson of Cato *the Censor*. It is said, that from his infancy he discovered by his speech, by his countenance, and even his childish sports and recreations, an inflexibility of mind; for he would force himself to go through with whatever he had undertaken, though the task was ill suited to his strength. He was rough towards those that flattered him, and quite intractable when threatened; was rarely seen to laugh, or even to smile; was not easily provoked to anger; but if once incensed, hard to be pacified. Sylla having had a friendship for the father of Cato, sent often for him and his brother, and talked familiarly with them. Cato, who was then about 14 years of age, seeing the heads of great men brought there, and observing the sighs of those that were present, asked his preceptor, "Why does no body kill this man?" Because, said the other, he is more feared than he is hated. The boy replied, Why then did you not give me a sword when you brought me hither, that I might have stabbed him, and freed my country from this slavery?

He learned the principles of the Stoic philosophy, which so well suited his character, under Antipater of Tyre, and applied himself diligently to the study of it. Eloquence he likewise studied, as a necessary means to defend the cause of justice, and he made a very considerable proficiency in that science. To increase his bodily strength, he inured himself to suffer the extremes of heat and cold; and used to make journeys on foot, and bare-headed in all seasons. When he was sick, patience and abstinence were his only remedies: he shut himself up, and would see no body till he was well. Though remarkably sober in the beginning of his life, making it a rule to drink but once after supper, and then retire, he insensibly contracted a habit of drinking more freely, and of sitting at table till morning. His friends endeavoured to excuse this, by saying that the affairs of the public engrossed his attention all the day; and that, being ambitious of knowledge, he passed the night in the conversation of philosophers. Cæsar wrote that Cato was once found dead drunk at the corner of a street, early in the morning, by a great number of people who were going to the levee of some great man; and that when, by uncovering his face, they perceived who it was, they blushed for shame: "You would have thought (added Cæsar), that Cato had found them drunk, not they him." Pliny observes, that by this reflection Cæsar praises his enemy at the same time that he blames him. And Seneca, his extravagant panegyrist, ventures to assert, that it is easier to prove drunkenness to be a virtue, than Cato to be vicious. He affected singularity, and, in things indifferent, to act directly contrary to the taste and fashions of the age. Magnanimity and constancy are generally ascribed to him; and Seneca would fain make that haughtiness and contempt for others which, in Cato, accompanied those virtues, a matter of praise. Cato, says Seneca, having received a blow in the face, neither took revenge nor was angry; he did not even *pardon the affront*, but *denied that he had received it*. His virtue raised him so high, that injury could not reach him. He is reputed to have been chaste in his youth. His first love was Lepida; but when the marriage was upon the point of being concluded, Metellus Scipio, to whom she had been promised, interfered, and the preference was given to him. This affront extremely exasperated our Stoic. He was for going to law with Scipio; and when his friends had diverted him from that design, by showing him the ridicule of it, he revenged himself by making verses upon his rival. When this first flame subsided, he married Attilia the daughter of Serranus, had two children by her, and afterwards divorced her for her very indiscreet conduct.

He served as a volunteer under Gellius in the war of Spartacus; and when military rewards were offered him by the commander, he refused them, because he thought he had no right to them. Some years after, he went a legionary tribune into Macedonia under the prætor Rubrius: in which station he appeared, in his dress, and during a march, more like a private soldier than an officer: but the dignity of his manners, the elevation of his sentiments, and the superiority of his views, set him far above those who bore the titles of generals and proconsuls. It is said, that Cato's design in all his behaviour was to engage the soldiers to the love of virtue; whose affections he engaged thereby to himself, without his having that in his intention. "For the sincere love of virtue, (adds Plutarch), in-

Cato.

plies an affection for the virtuous. Those who praise the worthy without loving them, pay homage to their glory; but are neither admirers nor imitators of their virtues." When the time of his service expired, and he was leaving the army, the soldiers were all in tears; so effectually had he gained their hearts by his condescending manners, and sharing in their labours. After his return home, he was chosen to the questorship; and had scarce entered on his charge, when he made a great reformation in the questor's office, and particularly with regard to the registers. These registers, whose places were for life, and through whose hands passed incessantly all the public accounts, being to act under young magistrates unexperienced in business, assumed an air of importance; and, instead of asking orders from the questors, pretended to direct and govern as if they themselves were the questors. Cato reduced them to their proper sphere.

One thing by which Cato extremely pleased the people, was his making the assassins to whom Sylla had given considerable rewards out of the treasury, for murdering the proscribed, disgorge their gains. Plutarch tells us, that Cato was so exact in discharging the duties of a senator, as to be always the first who came to the house, and the last who left it; and that he never quitted Rome during those days when the senate was to sit. Nor did he fail to be present at every assembly of the people, that he might awe those who, by an ill-judged facility, bestowed the public money in largesses, and frequently, through mere favour, granted remission of debts due to the state. At first his austerity and stiffness displeased his colleagues; but afterwards they were glad to have his name to oppose to all the unjust solicitations, against which they would have found it difficult to defend themselves. Cato very readily took upon him the task of refusing.

Cato, to keep out a very bad man, put in for the tribunate. He sided with Cicero against Catiline, and opposed Cæsar on that occasion. His enemies sent him to recover Cyprus, which Ptolemy had forfeited, thinking to hurt his reputation by so difficult an undertaking; yet none could find fault with his conduct.

Cato laboured to bring about an agreement between Cæsar and Pompey; but seeing it in vain, he sided with the latter. When Pompey was slain, he fled to Utica; and being pursued by Cæsar, advised his friends to be gone, and throw themselves on Cæsar's clemency. His son, however, remained with him; and Statilius, a young man, remarkable for his hatred to Cæsar.

The evening before the execution of the purpose he had formed with regard to himself, after bathing, he supped with his friends and the magistrates of the city. They sat late at table, and the conversation was lively. The discourse falling upon this maxim of the Stoics, that "the wise man alone is free, and that the vicious are slaves;" Demetrius, who was a Peripatetic, undertook to confute it from the maxims of his school. Cato, in answer, treated the matter very amply; and with so much earnestness and vehemence of voice, that he betrayed himself, and confirmed the suspicions of his friends, that he designed to kill himself. When he had done speaking, a melancholy silence ensued; and Cato perceiving it, turned the discourse to the present situation of affairs, expressing his concern for those who had been obliged to put to sea, as well as for those who had determined to make their escape by land, and had a dry and sandy desart to pass. After supper, the company being dismissed, he walked for some time with a few friends, and gave his orders to the officers of the guard: and going into his chamber, he embraced his son and his friends with more than usual tenderness, which farther confirmed the suspicions of the resolution he had taken. Then laying himself down on his bed, he took up Plato's Dialogue on the immortality of the Soul. Having read for some time, he looked up, and missing his sword, which his son had removed while he was at supper, he called a slave, and asked who had taken it away; and receiving no pertinent answer, he resumed his reading. Some time after, he asked again for his sword; and, without showing any impatience, ordered it to be brought to him: but, having read out the book, and finding nobody had brought him his sword, he called for all his servants, fell into a rage, and struck one of them on the mouth with so much violence, that he very much hurt his own hand, crying out in a passionate manner, "What! do my own son and family conspire to betray me, and deliver me up naked and unarmed to the enemy?" Immediately his son and friends rushed into the room; and began to lament, and to beseech him to change his resolution. Cato raising himself, and looking fiercely at them, "How long is it," said he," since I have lost my senses, and my son is become my keeper? Brave and generous son, why do you not bind your father's hands, that when Cæsar comes, he may find me unable to defend myself? Do you imagine that without a sword I cannot end my life? Cannot I destroy myself by holding by breath for some moments, or by striking my head against the wall?" His son answered with his tears, and retired. Apollonides and Demetrius remained with him, and to them he addressed himself in the following words: "Is it to watch over me that ye sit silent here? Do you pretend to force a man of my years to live? or can you bring any reason to prove, that it is not base and unworthy of Cato to beg his safety of an enemy? or why do you not persuade me to unlearn what I have been taught, that, rejecting all the opinions I have hitherto defended, I may now, by Cæsar's means, grow wiser, and be yet more obliged to him than for life alone? Not that I have determined any thing concerning myself; but I would have it in my power to perform what I shall think fit to resolve upon: and I shall not fail to ask your counsel, when I have occasion to act up to the principles which your philosophy teaches. Go tell my son, that he should not compel his father to what he cannot persuade him." They withdrew, and the sword was brought by a young slave. Cato drew it, and finding the point to be sharp; "Now, (said he), I am my own master:" And, laying it down, he took up his book again, which, it is reported, he read twice over. After this he slept so soundly that he was heard to snore by these who were near him. About midnight he called two of his freedmen, Cleanthes his physician, and Butas whom he chiefly employed in the management of his affairs. The last he sent to the port, to see whether all the

Romans

Romans were gone; to the phyſician he gave his hand to be dreſſed, which was ſwelled by the blow he had given his ſlave. This being an intimation that he intended to live, gave great joy to his family. Butas ſoon returned, and brought word that they were all gone except Craſſus, who had ſtaid upon ſome buſineſs, but was juſt ready to depart. He added, that the wind was high, and the ſea rough. Theſe words drew a ſigh from Cato. He ſent Butas again to the port, to know whether there might not be ſome one, who, in the hurry of embarkation, had forgot ſome neceſſary proviſions, and had been obliged to put back to Utica. It was now break of day, and Cato ſlept yet a little more, till Butas returned to tell him, that all was perfectly quiet. He then ordered him to ſhut his door; and he flung himſelf upon his bed, as if he meant to finiſh his night's reſt; but immediately he took his ſword, and ſtabbed himſelf a little below his cheſt; yet not being able to uſe his hand ſo well by reaſon of the ſwelling, the blow did not kill him. It threw him into a convulſion, in which he fell from his bed, and overturned a table near it. The noiſe gave the alarm; and his ſon, and the reſt of the family, entering the room, found him weltering in his blood, and his bowels half out of his body. The ſurgeon, upon examination, found that his bowels were not cut; and was preparing to replace them, and bind up the wound, when Cato, recovering his ſenſes, thruſt the ſurgeon from him, and tearing out his bowels immediately expired, in the 48th year of his age.

By this raſh act, independent of all moral or religious conſiderations, he carried his patriotiſm to the higheſt degree of political frenzy: for Cato, dead, could be of no uſe to his country; but had he preſerved his life, his counſel might have moderated Cæſar's ambition, and (as Monteſquieu obſerves) have given a different turn to public affairs.

CATOCHE, or Catochus, a diſeaſe by which the patient is rendered in an inſtant as immoveable as a ſtatue, without either ſenſe or motion, and continues in the ſame poſture he was in at the moment of his being ſeized. See (the *Index* ſubjoined to) Medicine.

# CATOPTRICS.

Catoptrics is that part of optics which explains the properties of reflected light, and particularly that which is reflected from mirrors.

As this and the other branches of Optics are fully treated under the collective word, we ſhall, in the preſent article, *1ſt*, Juſt give a ſummary of the principles of the branch, in a few plain aphoriſms, with ſome preliminary definitions; and, *2dly*, Inſert a ſet of entertaining experiments founded upon them.

### Sect. I. *Definitions.*

1 Definitions

1. Every poliſhed body that reflects the rays of light is called a mirror, whether its ſurface be plane, ſpherical, conical, cylindric, or of any other form whatever.

Plate CXXVIII.

2. Of mirrors there are three principally uſed in optical experiments: The plane mirror G H I, (fig. 1.); The ſpherical convex mirror, G H I, (fig. 2.) and the ſpherical concave mirror GHI, (fig. 3.).

3. The point K, (fig. 2, 3.) round which the reflecting ſurface of a ſpherical mirror is deſcribed, is called its centre. The line KH, drawn from its centre perpendicular to its two ſurfaces, is the axis of the mirror; and the point H, to which that line is drawn, is its vertex.

4. The diſtance between the lines AG and BG, (fig. 1.) is called the angle of incidence, and the diſtance between BG and CG is the angle of reflection.

### Sect. II. *Aphoriſms.*

2 I. In a plain mirror.

1. The image DF, (fig. 1.) will appear as far behind the mirror, as the object AC is before it.

2. The image will appear of the ſame ſize, and in the ſame poſition as the object.

3. Every ſuch mirror will reflect the image of an object of twice its own length and breadth.

4. If the object be an opaque body, and its rays fall on the mirror nearly in direct lines, there will be only one image viſible, which will be reflected by the inner ſurface of the glaſs. But,

5. If the object be a luminous body, and its rays fall very obliquely on the mirror, there will appear, to an eye placed in a proper poſition, ſeveral images; the firſt of which, reflected from the outer ſurface of the glaſs, will not be ſo bright as the ſecond, reflected from the inner ſurface. The following images, that are produced by the repeated reflections of the rays between the two ſurfaces of the glaſs, will be in proportion leſs vivid, to the eighth or tenth, which will be ſcarce viſible.

3 II. In a ſpherical convex mirror.

1. The image DF, (fig. 2.) will always appear behind it.

2. The image will be in the ſame poſition as the object. 3. It will be leſs than the object.

4. It will be curved, but not, as the mirror, ſpherical.

5. Parallel rays falling on this mirror will have the focus or image at half the diſtance of the centre K, from the mirror.

6. In converging rays, the diſtance of the object muſt be equal to half the diſtance of the centre, to make the image appear behind the mirror.

7. Diverging rays will have their image at leſs than half the diſtance of the centre. If the object be placed in the centre of the mirror, its image will appear at one-eighth of that diſtance behind it.

4 III. In a ſpherical concave mirror.

1. That point where the image appears of the ſame dimenſions as the object, is the centre of that mirror.

2. Parallel rays will have their focus at one-half the diſtance of the centre.

3. Converging rays will form an image before the mirror.

4. In diverging rays, if the object be at leſs than one half the diſtance of the centre, the image will be behind the mirror, erect, curved, and magnified, as

DEF, (fig. 3.) but if the distance of the object be greater, the image will be before the mirror, inverted and diminished, as DEF, (fig. 4.)

5. The sun's rays falling on a concave mirror, and being parallel, will be collected in a focus at half the distance of its centre, where their heat will be augmented in proportion of the surface of the mirror to that of the focal spot.

6. If a luminous body be placed in the focus of a concave mirror, its rays being reflected in parallel lines will strongly enlighten a space of the same dimension with the mirror, at a great distance. If the luminous object be placed nearer than the focus, its rays will diverge, and consequently enlighten a larger space. It is on this principle that reverberators are constructed.

IV. In all plane and spherical mirrors the angle of incidence is equal to the angle of reflection.

### Sect. III. *Entertaining Experiments.*

5 I. Catroptical illusions.

I. Of all our senses the sight is certainly subject to the greatest illusion. The various writers on optics have described a great number of instances in which it deceives us, and have constantly endeavoured to investigate the causes, to explain their effects, and to reconcile appearance with reality. We every day discover new phenomena, and doubtless many more are reserved for posterity. It frequently happens, moreover, that a discovery which at first seemed of little consequence, has led to matters of the highest importance.

Take a glass bottle A (fig. 14.) and fill it with water to the point B; leave the upper part BC empty, and cork it in the common manner. Place this bottle opposite a concave mirror, and beyond its focus, that it may appear reversed, and before the mirror (see sect. ii. aphor. 4. of a spher. concave mirror,) place yourself still further distant from the bottle, and it will appear to you in the situation, *a*, *b*, *c*, (fig. 15.)

Now it is remarkable in this apparent bottle, that the water, which, according to all the laws of catoptrics, and all the experiments made on other objects, should appear at *a b*, appears on the contrary at *b c*, and consequently the part *a b* appears empty.

If the bottle be inverted and placed before the mirror (as in fig. 16.), its image will appear in its natural, erect position; and the water, which is in reality at BC, will appear at *a b*.

If while the bottle is inverted it be uncorked, and the water run gently out, it will appear, that while the part BC is emptying, that of *a b* in the image is filling; and what is likewise very remarkable, as soon as the bottle is empty the illusion ceases, the image also appearing entirely empty. If the bottle likewise be quite full there is no illusion.

If while the bottle is held inverted, and partly empty, some drops of water fall from the bottom A towards BC, it seems in the image as if there were formed at the bottom of the part *a b*, bubbles of air that rose from *a* to *b*; which is the part that seems full of water. All these phenomena constantly appear.

The remarkable circumstances in this experiment, are, first, not only to see an object where it is not, but also where its image is not; and secondly, that of two objects which are really in the same place, as the surface of the bottle and the water it contains, the one is seen at one place, and the other at another; and to see the bottle in the place of its image, and the water where neither it nor its image are.

6 II. Appearance of a boundless vista. fig. 5.

II. Construct a box A B, of about a foot long, eight inches wide, and six high; or what other dimension you shall think fit, provided it does not greatly vary from these proportions.

On the inside of this box, and against each of its opposite ends A and B, place a mirror of the same size. Take off the quicksilver from the mirror that you place at B, for about an inch and an half, at the part C, where you are to make a hole in the box of the same size, by which you may easily view its inside. Cover the top of the box with a frame, in which must be placed a transparent glass, covered with gauze, on the side next the inner part of the box. Let there be two grooves at the parts E and F to receive the two painted scenes hereafter mentioned. On two pieces of cut pasteboard let there be skilfully painted on both sides (see fig. 6. and 7.) any subject you think proper; as woods, gardens, bowers, colonades, *&c.* and on two other pastebords, the same subjects on one side only; observing that there ought to be on one of them some object relative to the subject placed at A, that the mirror placed at D may not reflect the hole at C on the opposite side.

Place the two boards painted on both sides in the grooves E and F; and those that are painted on one side only, against the opposite mirrors C and D; and then cover the box with its transparent top. This box should be placed in a strong light to have a good effect.

When the eye is placed at C, and views the objects on the inside of the box, of which some, as we have said, are painted on both sides, they are successively reflected from one mirror to the other; and if, for example, the painting consists of trees, they will appear like a very long vista, of which the eye cannot discern the end; for each of the mirrors repeating the objects, continually more faintly, contribute greatly to augment the illusion.

7 III. Of a fortification of immense extent, fig. 8.

III. Take a square box ABCD, of about six inches long, and twelve high; cover the inside of it with four plane mirrors, which must be placed perpendicular to the bottom of the box CHFD.

Place certain objects in relief on the bottom of this box; suppose, for example, a piece of fortification, (as fig. 9.) with tents, soldiers, &c. or any other subject that you judge will produce an agreeable effect by its disposition when repeatedly reflected by the mirrors.

On the top of this box place a frame of glass, in form of the bottom part of a pyramid, whose base AGEB is equal to the size of the box: its top ILN, must form a square of six inches, and should not be more than four or five inches higher than the box. Cover the four sides of this frame with a gauze, that the inside may not be visible but at the top ILN, which should be covered with a transparent glass.

When you look into this box through the glass ILN, the mirrors that are diametrically opposite each other, mutually reflecting the figures inclosed, the eye beholds a boundless extent, completely covered with these

these objects; and if they are properly disposed, the illusion will occasion no small surprize, and afford great entertainment.

Note, The nearer the opening ILN is to the top of the box, the greater will be the apparent extent of the subject. The same will happen if the four mirrors placed on the sides of the box be more elevated. The objects, by either of these dispositions will appear to be repeated nine, twenty-five, forty-nine times, &c. by taking always the square of the odd numbers of the arithmetical progression 3, 5, 7, 9, &c. as is very easy to conceive, if we remember that the subject enclosed in the box is always in the centre of a square, composed of several others, equal to that which forms the bottom of the box.

Other pieces of the same kind (that is viewed from above) may be contrived, in which mirrors may be placed perpendicular on a triangular, pentagon, or hexagon, (that is, a three, five, or six-sided) plane. All these different dispositions, properly directed, as well with regard to the choice as position of the objects, will constantly produce very remarkable and pleasing illusions.

If instead of placing the mirrors perpendicular, they were to incline equally, so as to form part of a reversed pyramid, the subject placed in the box would then have the appearance of a very extensive globular or many-sided figure.

8 IV. Surprising multiplication of objects, fig. 10.

IV. On the hexagonal or six-sided plane ABCDEF draw six-semi-diameters GA, GB, GC, GD, GE, GF; and on each of these place perpendicularly two plane mirrors, which must join exactly at the centre G, and which placed back to back must be as thin as possible. Decorate the exterior boundary of this piece (which is at the extremity of the angles of the hexagon) with six columns, that at the same time serve to support the mirrors, by grooves formed on their inner sides. (See the profile H). Add to these columns their entablatures, and cover the edifice in such manner as you shall think proper.

In each one of these six triangular spaces, contained between the mirrors, place little figures of pasteboard, in relief, representing such objects as when seen in an hexagonal form will produce an agreeable effect. To these add small figures of enamel; and take particular care to conceal, by some object that has relation to the subject, the place where the mirrors join, which, as we have said before, all meet in the common centre G.

When you look into any one of the six openings of this palace, the objects there contained being repeated six times, will seem entirely to fill up the whole of the building. This illusion will appear very remarkable; especially if the objects made choice of are properly adapted to the effect that is to be produced by the mirrors.

Note, if you place between two of these mirrors part of a fortification, as a curtain and two demi-bastions, you will see an entire citadel, with its six bastions. Or if you place part of a ball-room, ornamented with chandeliers and figures in enamel, all those objects being here multiplied, will afford a very pleasing prospect.

9 V. Opaque bodies seemingly rendered transparent fig. 11.

V. Within the case ABCD, place four mirrors, O, P, Q, R, so disposed that they may each of them make an angle of forty-five degrees, that is, that they may be half way inclined from the perpendicular, as in the figure. In each of the two extremities AB, make a circular overture, in one of which fix the tube GL, in the other the tube MF, and observe that in each of these is to be inserted another tube, as H and I (A).

Furnish the first of these tubes with an object-glass at G, and a concave eye-glass at F. You are to observe that in regulating the focus of these glasses, with regard to the length of the tube, you are to suppose it equal to the line G, or visual pointed ray, which entering at the overture G, is reflected by the four mirrors, and goes out at the other overture F, where the ocular glass is placed. Put any glass you will into the two ends of the moveable tubes H and I; and lastly place the machine on a stand E, moveable at the point S, that it may be elevated or depressed at pleasure.

When the eye is placed at F, and you look through the tube, the rays of light that proceed from the object T, passing through the glass G, are successively reflected by the mirrors, O, P, Q, and R, to the eye at F, and there paint the object T, in its proper situation, and these rays appear to proceed directly from that object.

The two moveable tubes H and I, at the extremities of each of which a glass is placed, serve only the more to disguise the illusion, for they have no communication with the interior part of the machine. This instrument being moveable on the stand E, may be directed to any object; and if furnished with proper glasses will answer the purpose of a common perspective.

The two moveable tubes H and I being brought together, the machine, is directed toward any object, and desiring a person to look in at the end F, you ask him if he see distinctly that object. You then separate the two moveable tubes, and leaving a space between them sufficient to place your hand, or any other solid body, you tell him that the machine has the power of making objects visible through the most obaque body; and as a proof you desire him then to look at the same object, when, to his great surprize, he will see it as distinct as when there was no solid body placed between the tubes.

Note, This experiment is the more extraordinary, as it is very difficult to conceive how the effect is produced. The two arms of the case appearing to be made to support the perspective glass; and to what ever object it is directed, the effect is still the same.

VI.

(A) These four tubes must terminate in the substance of the case, and not enter the inside, that they may not hinder the effect of the mirrors. The fourfold reflection of the rays of light from the mirrors, darkens in some degree the brightness of the object; some light is also lost by the magnifying power of the perspective: If, therefore, instead of the object-glass at G, and concave eye-glass at F, plain glasses were substituted; the magnifying power of the perspective will be taken away, and the object will appear brighter.

10 VI. VII The magician's Mirrors, fig. 12.

VI. In the partition AB, make two overtures, CD, and EF, of a foot high, and ten inches wide, and about a foot distant from each other. Let them be at the common height of a man's head; and in each of them place a transparent glass, surrounded with a frame like a common mirror.

Behind this partition place two mirrors H and I, inclined to it in an angle of forty-five degrees: that is half-way between a line drawn perpendicular to the ground and its surface; let them be both 18 inches square: let all the space between them be inclosed by boards or pasteboard painted black, and well closed, that no light may enter: let there be also two curtains to cover them, which may be drawn aside at pleasure.

When a person looks into one of these supposed mirrors, instead of seeing his own face, he will perceive the object that is in front of the other: so that if the two persons present themselves at the same time before these mirrors, instead of each one seeing himself, they will reciprocally see each other.

Note, There should be a sconce with a candle placed on each side of the two glasses in the wainscot, to enlighten the faces of the persons who look in them, otherwise this experiment will have no remarkable effect.

This experiment may be considerably improved by placing the two glasses in the partition in adjoining rooms, and a number of persons being previously placed in one room, when a stranger enters the other, you may tell him his face is dirty; and desire him to look in the glass, which he will naturally do; and on seeing a strange face he will draw back: but returning to it, and seeing another, another, and another, like the phantom kings of Macbeth, what his surprize will be is more easy to conceive then express. After this a real mirror may be privately let down on the back of the glass; and if he can be prevailed to look in it once more, he will then, to his further astonishment, see his own face; and may be told, perhaps persuaded, that all he thought he saw before was mere imagination.

How many tricks, less artful than this, have passed in former times for sorcery; and pass at this time, in some countries, for apparitions?

Note, When a man looks in a mirror that is placed perpendicular to another, his face will appear entirely deformed. If the mirror be a little inclined, so as to make an angle of 80 degrees (that is, one-ninth part from the perpendicular), he will then see all the parts of his face, except the nose and forehead. If it be inclined to 60 degrees (that is one-third part), he will appear with three noses and six eyes: in short, the apparent deformity will vary at each degree of inclination; and when the glass comes to 45 degrees (that is, half way down), the face will vanish. If, instead of placing the two mirrors in this situation, they are so disposed that their junction may be vertical, their different inclinations will produce other effects; as the situation of the object relative to these mirrors is quite different. The effects of these mirrors, though remarkable enough, occasions but little surprise, as there is no method of concealing the cause by which they are produced.

Fig. 13. VII. Make a box of wood, of a cubical figure, ABCD, of about 15 inches every way. Let it be fixed on the pedestal P, at the usual height of a man's head. In each side of this box let there be an opening of an oval form, of ten inches high, and seven wide.

In this box place two mirrors A, D, with their backs against each other; let them cross the box in a diagonal line, and in a vertical position. Decorate the openings in the sides of this box with four oval frames and transparent glasses, and cover each of them with a curtain, so contrived that they may all draw up together.

Place four persons in front of the four sides, and at equal distances from the box, and then draw up the curtains that they may see themselves in the mirrors; when each of them, instead of his own figure, will see that of the person who is next him, and who, at the same time, will seem to him to be placed on the opposite side. Their confusion will be the greater, as it will be very difficult for them to discover the mirrors concealed in the box. The reason of this phænomenon is evident; for though the rays of light may be turned aside by a mirror, yet as we have before said, they always appear to proceed in right lines.

12 VIII. The perspective mirror, fig. 17.

VIII. Provide a box ABCD of about two feet long, 15 inches wide, and 12 inches high. At the end AC place a concave mirror, the focus of whose parallel rays is at 18 inches from the reflecting surface. At IL place a pasteboard blacked, in which a hole is cut sufficiently large to see on the mirror H the object placed at BEFD.

Cover the top of the box, from A to I, close, that the mirror H may be entirely darkened. The other part IB, must be covered with a glass, under which is placed a gauze.

Make an aperture at G, near the top of the side E B; beneath which, on the inside, place in succession paintings of different subjects, as vistas, landscapes, *&c.* so that they may be in front of the mirror H. Let the box be so placed that the object may be strongly illuminated by the sun, or by wax lights placed under the enclosed part of the box AI.

By this simple construction the objects placed at GD will be thrown into their natural perspective; and if the subjects be properly chosen, the appearance will be altogether as pleasing as in optical machines of a much more complicated form.

Note, A glass mirror should be always here used, as those of metal do not represent the objects with equal vivacity, and are beside subject to tarnish. It is also necessary that the box be sufficiently large, that you may not be obliged to use a mirror whose focus is too short; for in that case, the right lines near the border of the picture will appear bent in the mirror, which will have a disagreeable effect, and cannot be avoided.

13 IX. To set fire to a combustible body by the reflection of two concave mirrors, fig. 18.

IX. The rays of a luminous body placed in the focus of a concave mirror being reflected in parallel lines, if a second mirror be placed diametrically opposite the first, it will, by recollecting those rays in its focus, set fire to a combustible body.

Place two concave mirrors, A and B, at about 12 or 15 feet distance from each other, and let the axis of each of them be in the same line. In the focus C of one of them, place a live coal, and in the focus D of the other, some gun-powder. With a pair of double bellows, which make a continual blast, keep constantly blowing the coal, and notwithstanding the distance between them, the powder will presently take fire.

It is not necessary that these mirrors be of metal or brass, those made of wood or pasteboard, gilded, will produce the explosion, which has sometimes taken effect at the distance of 50 feet, when mirrors of eighteen inches, or two feet diameter, have been used.

This experiment succeeds with more difficulty at great distances; which may proceed from the moisture in a large quantity of air. It would doubtless take effect more readily, if a tin tube, of an equal diameter with the mirrors, were to be placed between them.

14 The real apparition, fig. 19.

X. Behind the partition AB, place, in a position something oblique, the concave mirror EF, which must be at least ten inches in diameter, and its distance from the partition equal to three-fourths of the distance of its centre.

In the partition make an opening of seven or eight inches, either square or circular: it must face the mirror, and be of the same height with it. Behind this partition place a strong light, so disposed that it may not be seen at the opening, and may illumine an object placed at C, without throwing any light on the mirror.

Beneath the aperture in the partition place the object C, that you intend shall appear on the outside of the partition, in an inverted position; and which we will suppose to be a flower. Before the partition, and beneath the aperture, place a little flower-pot D, the top of which should be even with the bottom of the aperture, that the eye, placed at G, may see the flower in the same position as if its stalk came out of the pot.

Take care to paint the space between the back part of the partition and the mirror black, to prevent any reflections of light from being thrown on the mirror; in a word, so dispose the whole that it may be as little enlightened as possible.

When a person is placed at the point G, he will perceive the flower that is behind the partition, at the top of the pot at D, but on putting out his hand to pluck it, he will find that he attempts to grasp a shadow.

If in the opening of the partition a large double convex lens of a short focus be placed, or, which is not quite so well, a bottle of clear water, the image of the flower reflected thereon will appear much more vivid and distinct.

*Observation.* The phenomena that may be produced by means of concave mirrors are highly curious and astonishing. By their aid, spectres of various kinds may be exhibited. Suppose, for example, a person with a drawn sword places himself before a large concave mirror, but farther from it than its focus; he will then see an inverted image of himself in the air, between him and the mirror, of a less size than himself. If he steadily present the sword towards the centre of the mirror, an image of the sword will come out therefrom towards the sword in his hand, point to point, as it were to fence with him; and by his pushing the sword nearer the image will appear to come nearer him, and almost to touch his breast, having a striking effect upon him. If the mirror be turned 45 degrees, or one-eighth round, the reflected image will go out perpendicular to the direction of the sword presented, and apparently come to another person placed in the direction of the motion of the image. If that person is unacquainted with the experiment, and does not see the original sword, he will be much surprised and alarmed.—This experiment may be another way diversified, by telling any person, that at such an hour, and in such a place, he should see the apparition of an absent or deceased friend (of whose portrait you are in possession). In order to produce this phantom, instead of the hole in the partition AB in the last figure, there must be a door which opens into an apartment to which there is a considerable descent. Under that door you are to place the portrait, which must be inverted and strongly illuminated, that it may be lively reflected by the mirror, which must be large and well polished. Then having introduced the incredulous spectator at another door, and placed him in the proper point of view, you suddenly throw open the door at AB, when, to his great astonishment, he will immediately see the apparition of his friend.

It will be objected, perhaps, that this is not a perfect apparition, because it is only visible at one point of view, and by one person. But it should be remembered, that it was an established maxim in the last centuries, that a spectre might be visible to one person and not to others. So Shakespeare makes both Hamlet and Macbeth see apparitions that were not visible to others, present at the same time. It is not unlikely, moreover, that this maxim took its rise from certain apparitions of this kind that were raised by the monks, to serve some purposes they called religious; as they alone were in possession of what little learning there then was in the world.

Opticians sometimes grind a glass mirror concave in one direction only, as it is said longitudinally; it is in fact a concave portion of a cylinder, the breadth of which may be considered that of the mirror. A person looking at his face in this mirror, in the direction of its concavity, will see it curiously distorted in a very lengthened appearance; and by turning the cylindrical mirror a quarter round, his visage will appear distorted another way, by an apparent increase in width only. Another curious and singular property attends this sort of mirrors: If in a very near situation before it, you put your finger on the right hand side of your nose, it will appear the same in the mirror; but if in a distant situation, somewhat beyond the centre of concavity, you again look at your face in the mirror, your finger will appear to be removed to the other or left-hand side of your nose. This, though something extraordinary, will in its cause appear very evident from a small consideration of the properties of spherical concave mirrors.

CATOPTROMANCY, Κατοπτρομαντεια, a kind of divination among the ancients; so called, because, consisting in the application of a mirror. The word is formed from κατοπτρον, *speculum* "mirror," and μαντεια, *divinatio*, "divination." Pausanias says, it was in use among the Achaians; where those who were sick, and in danger of death, let down a mirror, or looking-glass fastened by a thread, into a fountain before the temple of Ceres; then, looking in the glass, if they saw a ghastly disfigured face, they took it as a sure sign of death: on the contrary, if the flesh appeared fresh and healthy, it was a token of recovery. Sometimes glasses were used without water, and the images of things future represented in them. See GASTROMANCY.

CATROU, (Francis) a famous Jesuit, born at Paris in 1659. He was engaged for twelve years in the *Journal de Trevoux*, and applied himself at the same time to other works, which distinguished him among the learned. He wrote a general History of the Mogul empire, and a Roman history, in which he was assisted by father Rouille, a brother jesuit. Catrou died in 1737; and this last history was continued by Rouille, who died in 1740.

CATTERTHUN, a remarkable Caledonian post, a few miles north of the town of Brechin in the county of Angus in Scotland. Mr Pennant describes it as of uncommon strength. "It is (says he) of an oval form made of a stupendous dike of loose white stones, whose convexity, from the base within to that without, is 122 feet. On the outside a hollow, made by the disposition of the stones, surrounds the whole. Round the base is a deep ditch, and below that about 100 yards, are vestiges of another, that went round the hill. The area within the stony mound is flat; the axis, or length of the oval, is 436 feet, the transverse diameter 200. Near the east side is the foundation of a rectangular building; and on most parts are the foundations of others small and circular: all which had once their superstructures, the shelter of the possessors of the post: there is also a hollow, now almost filled with stones, the well of the place." There is another fortification, but of inferior strength, in the neighbourhood. It is called the *Brown Catterthun*, from the colour of the ramparts which are composed only of earth. It is of a circular form, and consists of various concentric dikes. On one side of this rises a small rill, which, running down the hill, has formed a deep gully. From the side of the fortress is another rampart, which extends parallel to the rill, and then reverts, forming an additional post or retreat. The meaning of the word *Catter-thun* is *Camp-town*; and Mr Pennant thinks these might probably be the posts occupied by the Caledonians before their engagement at the foot of the Grampian Mountains with the celebrated Agricola. See (*History of*) SCOTLAND.

CATTI, a people of Germany, very widely spread, on the east reaching to the river Sala, on the north to Westphalia; occupying, besides Hesse, the Wetterau, and part of the tract on the Rhine, and on the banks of the river Lohne. The Hercynian forest began and ended in their country.

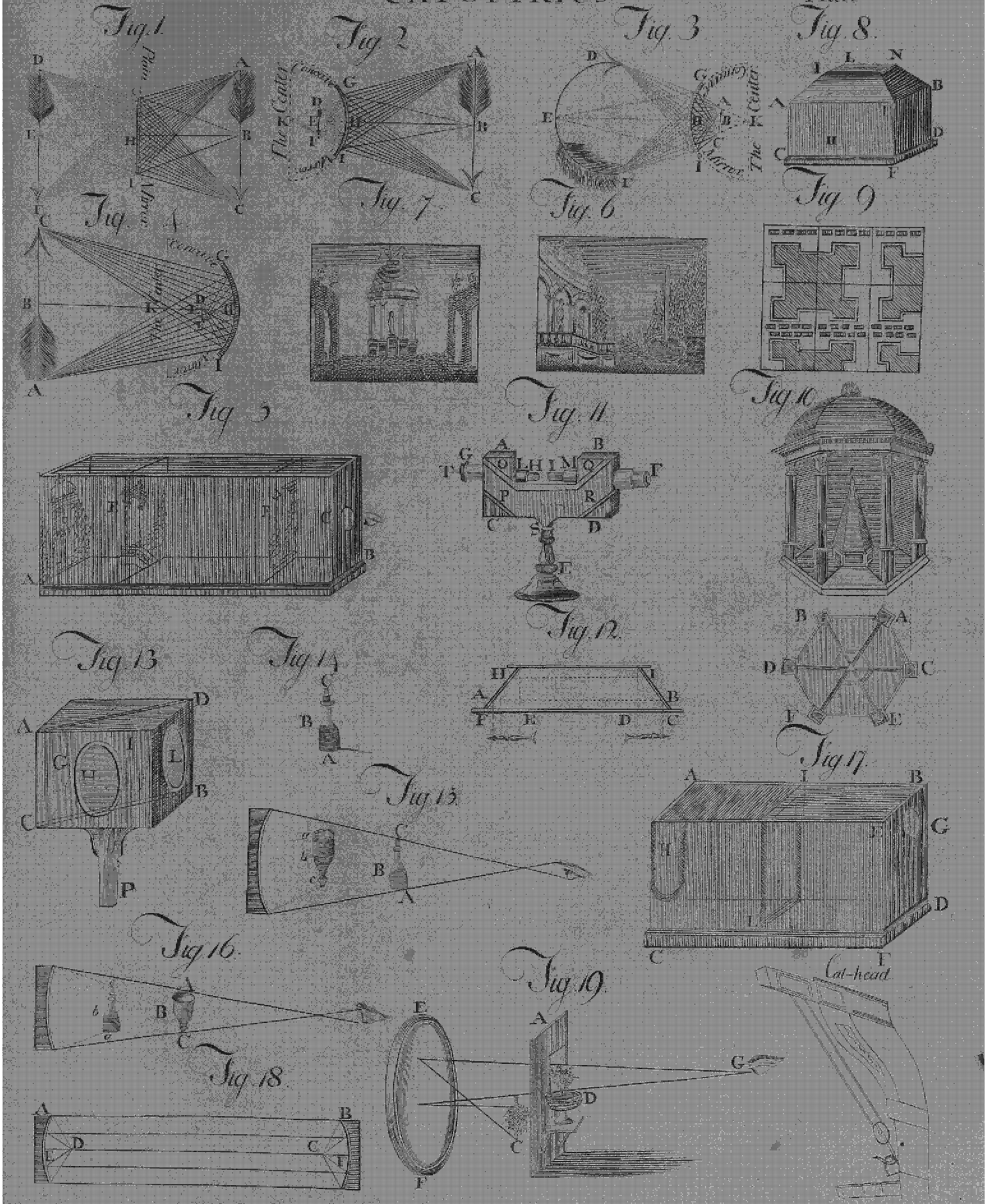
CATTIVELLAUNI, anciently a people of Britain, seated in the country which is now divided into the counties of Hertford, Bedford, and Bucks. The name of this ancient British people is written in several different ways by Greek and Roman authors being sometimes called Catti, Cassii, Catticuclani, Cattidudani, Catticludani, &c. That they were of Belgic origin cannot be doubted, and it is not improbable, that they derive their name of Catti from the Belgic word Kattin, which signifies illustrious or noble, and that the addition of Vellauni, which means on the banks of rivers, might be given them after their arrival in Britain, as descriptive of the situation of their country. However this may be, the Cattivellauni formed one of the most brave and warlike of the ancient British nations when Cæsar invaded Britain, and long after. Cassibelanus, their prince, was made commander in chief of the confederated Britons, not only on account of his own personal qualities, but also because he was at the head of one of their bravest and most powerful tribes. In the interval between the departure of Cæsar and the next invasion under Claudius, the Cattivellauni had reduced several of the neighbouring states under their obedience; and they again took the lead in the opposition to the Romans at their second invasion, under their brave but unfortunate prince Caractacus. The country of the Cattivellauni was much frequented and improved by the Romans, after it came under their obedience. Verulamium, their capital, which stood near where St Albans now stands, became a place of great consideration, was honoured with the name and privileges of a municipium or free city, and had magistrates after the model of the city of Rome. This place was taken and almost destroyed by the insurgents under Boadicea; but it was afterwards rebuilt, restored to its former splendor, and surrounded with a strong wall, some vestiges of which are still remaining. Durocobrivæ and Magiavintum, in the second iter of Antoninus, were probably Dunstable and Fenny-Stratford, at which places there appear to have been Roman stations. The Salena of Ptolemy, a town in the country of the Cattivellauni, was perhaps situated at Saludy, in Bedfordshire, where several Roman antiquities have been found. There were, besides these, several other Roman forts, stations, and towns in this country, which it would be tedious to enumerate. The territories of the Cattivellauni made a part of the Roman province called Britannia Prima.



CATTLE, a collective word, which signifies the fourfooted animals, which serve either for tilling the ground, or for food to men. They are distinguished into large, or black cattle; and into small cattle: of the former are horses, bulls, oxen, cows, and even calves and heifers; amongst the latter are rams, ewes, sheep, lambs, goats, kids, &c. Cattle are the chief stock of a farm: they who deal in cattle are styled graziers.

CATULLUS, (Caius Valerius) a Latin poet, born at Verona, in the year of Rome 666. The harmony of his numbers acquired him the esteem and friendship of Cicero, and other great men of his time. Many of his poems, however, abound with gross obscenities. He wrote satirical verses against Cæsar, under the name of Marmoro. He spent his whole life in a state of poverty; and died in the flower of his age, and the height of his reputation. Joseph Scaliger, Passerat, Muret, and Isaac Vossius, have written learned notes on this poet.

CATOPTRICS. Plate CXXVIII.



CATZ, (James) a great civilian, politician, and Dutch poet, was born at Browershaven, in Zealand, in the year 1577. After having made several voyages, he fixed at Middleburg; and acquired by his pleadings such reputation, that the city of Dort chose him for its pensionary; as did also, some time after, that of Middleburg. In 1634, he was nominated pensionary of Holland and West Friesland; and in 1648, he was elected keeper of the seal of the same state, and stadtholder of the fiefs: but some time after, he resigned these employments, to enjoy the repose which his advanced age demanded. As the post of grand pensionary had been fatal to almost all those who had enjoyed it, from the beginning of the republic till that time, Catz delivered up his charge on his knees, before the whole assembly of the states, weeping for joy, and thanking God for having preserved him from the inconveniences that seemed attached to the duties of that office. But though he was resolved to spend the rest of his days in repose, the love of his country engaged him to comply with the desires of the state, who importuned him to go on an embassy to England, in the delicate conjuncture in which the republic found itself during the protectorate of Cromwell. At his return, he retired to his fine country seat at Sorgvliet, where he lived in tranquillity till the year 1660, in which he died. He wrote a great number of poems in Dutch; most of which are on moral subjects, and so esteemed, that they have been often printed in all the different sizes; and next to the Bible, there is no work so highly valued by the Dutch.

CATZENELLIBOGEN, a town of Germany, in the lower part of the upper circle of the Rhine, with a strong castle. It is capital of a county of the same name. E. Long. 7. 38. N. Lat. 50. 20.

CAVA, in anatomy, the name of a vein, the largest in the body, terminating in the right ventricle of the heart. See ANATOMY, p. 751. col. 2.

CAVA, a considerable and populous town of Italy, in the kingdom of Naples, and in the Hither Principato, with a bishop's see. It is situated at the foot of Mount Metelian, in E. Long. 15. 5. N. Lat. 40. 40.

CAVAILLAN, a town of France in Contal Venaissin; with a bishop's see. It is situated on the river Durance, in a fertile and pleasant country. E. Long. 4. 17. N. Lat. 43. 52.

CAVALCADE, a formal pompous march or procession of horsemen, equipages, &c. by way of parade, or ceremony, as a grace to a triumph, public entry, or the like.

CAVALCADOUR, or CAVALCADEUR, anciently denoted a riding-master; but at present is disused in that sense, and only employed to denote a sort of equerries or officers who have the direction of princes stables. The French say, *ecuyer cavalcadeur* of the king, the duke of Orleans, &c. Menage writes it *cavalcadour*, and derives it from the Spanish *cavalgador*, a horseman.

CAVALCANTE, (Guido) a nobleman of Florence in the 13th century, who having followed the party of the Guelfes, experienced the changeableness of fortune. He showed great strength of mind in his misfortunes, and never neglected to improve his talents. He wrote a treatise in Italian concerning style, and some verses which are esteemed. His poem on the love of this world, has been commented on by several learned men.



CAVALIER, a horseman, or person mounted on horseback; especially if he be armed withal, and have a military appearance.

Anciently, the word was restrained to a knight, or *miles*. The French still use *Chevalier* in the same sense.

CAVALIER, considered as a faction. See BRITAIN, n° 109.

CAVALIER, in fortification, an elevation of earth of different shapes, situated ordinarily in the gorge of a bastion, bordered with a parapet, and cut into more or less embrasures, according to the capacity of the cavalier. Cavaliers are a double defence for the faces of the opposite bastion: they defend the ditch, break the besiegers galleries, command the traverses in dry moats, scour the saliant angle of the counterscarp, where the besiegers have their counter-batteries, and enfilade the enemies trenches, or oblige them to multiply their parallels: they are likewise very serviceable in defending the breach and the retrenchments of the besieged, and can very much incommode the entrenchments which the enemy make, being lodged in the bastion.

CAVALIER, in the menage, one that understands horses, and is practised in the art of riding them.

CAVALIERI, (Bonaventure) an eminent mathematician in the 17th century, a native of Milan, and a friar of the order of the Jesuati of St Jerome, was professor of mathematics at Bologna, where he published several mathematical books, particularly the *Method of Indivisibles*. He was a scholar of Galileo. His *Directorium generale Uranometricum* contains great variety of most useful practices in trigonometry and astronomy. His trigonometrical tables in that work are excellent.

CAVALRY, a body of soldiers that charge on horseback. The word comes from the French, *cavalerie*, and that from the corrupt Latin, *caballus*, a horse.

The Roman cavalry consisted wholly of those called *equites*, or knights, who were a distinct order in the distribution of citizens.—The Grecian cavalry were divided into *cataphracta* and *non cataphracta*, i. e. into heavy and light armed.—Of all the Greeks, the Thessalians excelled most in cavalry. The Lacedemonians, inhabiting a mountainous country, were but meanly furnished with cavalry, till, carrying their arms into other countries, they found great occasion for horses to support and cover their foot. The Athenian cavalry, for a considerable time, consisted only of 96 horsemen: after expelling the Persians out of Greece, they increased the number to 300: and afterwards to 1200, which was the highest pitch of the Athenian cavalry. The Turkish cavalry consists partly of Spahis, and partly of horsemen raised and maintained by the Zaims and Timariots.

The chief use of the cavalry is to make frequent excursions to disturb the enemy, intercept his convoys, and destroy the country: in battle to support and cover the foot, and to break through and disorder the enemy; also to secure the retreat of the foot. Formerly, the manner of the fighting of the cavalry was

was, after firing their piſtols or carabines, to wheel off, and to give opportunity for loading again. Guſtavus Adolphus is ſaid to have firſt taught the cavalry to charge through, to march ſtraight up to the enemy, with the ſword drawn in the bridlehand, and each man having fired his piece, at the proper diſtance, to betake himſelf to his ſword, and charge the enemy as was found moſt advantageous.

CAVAN, a town of Ireland, and capital of a county of the ſame name, in the province of Ulſter, ſituated in W. Long. 7. 32. N. Lat. 53. 40.

Cavan, a county of Ireland, 47 miles in length, and 23 in breadth; is bounded on the eaſt by Monaghan, and on the ſouth by Longford, Weſt-Meath, and Eaſt-Meath. It has but two towns of any note, viz. Cavan and Kilmore. It ſends five members to parliament; two for the county, two for Cavan, and one for Kilmore. It contains upwards of 8000 houſes, 37 pariſhes, ſeven baronies, and two boroughs.

CAUCASUS, the name of a very high mountain of Aſia, being one of that great ridge which runs between the Black and Caſpian ſeas. Sir John Chardin deſcribes this as the higheſt mountain, and the moſt difficult to paſs, of any he had ſeen. It has frightful precipices, and in many places the roads are cut out of the ſolid rock. At the time he paſſed it, the mountain was entirely covered with ſnow; ſo that, in many places, his guides behoved to clear the way with ſhovels. The mountain is 36 leagues over, and the ſummit of it eight leagues in breadth. The top is perpetually covered with ſnow: and our traveller relates, that the two laſt days he ſeemed to be in the clouds, and was not able to ſee 20 paces before him. Excepting the very top, however, all the parts of Mount Caucaſus are extremely fruitful; abounding in honey, corn, fruits, hogs, and large cattle. The vines twine about the trees, and riſe ſo high, that the inhabitants cannot gather the fruit from the uppermoſt branches. There are many ſtreams of excellent water, and a vaſt number of villages. The inhabitants are for the moſt part Chriſtians of the Georgian Church. They have fine complexions, and the women are very beautiful.—In the winter they wear ſnow-ſhoes in the form of rackets, which prevent their ſinking in the ſnow, and enable them to run upon it with great ſwiftneſs.

CAUDEBEC, a rich, populous, and trading town in Normandy, and capital of the territory of Caux. It is ſeated at the foot of a mountain near the river Seine, in E. Long. 0. 46. N. Lat. 40. 30.

CAUDEX, by Malphigi and other botaniſts, is uſed to ſignify the ſtem or trunk of a tree: by Linnæus, the ſtock or body of the root, part of which aſcends, part deſcends. The aſcending part raiſes itſelf gradually above ground, ſerving frequently for a trunk, and correſponds in ſome meaſure to the *caudex* of former writers: the deſcending part ſtrikes gradually downward into the ground, and puts forth radicles or ſmall fibres, which are the principal and eſſential part of every root. The deſcending caudex therefore correſponds to the radix of other botaniſts. Agreeably to this idea, Linnæus conſiders trees and ſhrubs as roots above ground; an opinion which is confirmed by a well-known fact, that trees, when inverted, put forth leaves from the deſcending caudex, and radicles or roots from the aſcending. For the varieties in the deſcending caudex, ſee the article Radix.



CAUDIUM, (anc. geog.) a town of Samnium, on the Via Appia, between Calatia and Beneventum: *Caudinus*, the epithet. The *Caudinae Furcae*, or *Furculae*, were memorable by the diſgrace of the Romans; being ſpears diſpoſed in the form of a gallows under which priſoners of war were made to paſs, and gave name to a defile or narrow paſs near *Caudium*, Livy; where the Samnites obliged the Roman army and the two conſuls to lay down their arms and paſs under the gallows, or yoke, as a token of ſubjection.

CAVE, any large ſubterraneous hollow. Theſe were undoubtedly the primitive habitations, before men began to build edifices above ground. The primitive method of burial was alſo to repoſite the bodies in caves, which ſeems to have been the origin of catacombs. They long continued the proper habitations of ſhepherds. Among the Romans, *caves (antra)* uſed to be conſecrated to nymphs, who were worſhipped in caves, as other gods were in temples. The Perſians alſo worſhipped their god Mithras in a natural cave, conſecrated for the purpoſe by Zoroaſter. The cave of the nymph Egeria is ſtill ſhown at Rome. Kircher, after Gaffarellus, enumerates divers ſpecies of caves; as divine, natural, &c.—Of natural caves ſome are poſſeſſed of a medicinal virtue, as the Grotto de Serpente; others are poiſonous or mephitical; ſome are replete with metalline exhalations, and others with waters. Divine caves were thoſe ſaid to affect the human mind and paſſions in various ways, and ever to inſpire with a knowledge of future events. Such were the ſacred caverns at Delphi which inſpired the Pythia; the Sibyl's cave at Cumæ, ſtill ſhown near the lake Avernus; the cave of Trophonius, &c.

Cave, (Dr William), a learned Engliſh divine born in 1637, educated in St John's college Cambridge; and ſucceſſively miniſter of Haſely in Oxfordſhire, Allhallows the Great in London, and of Iſlington. He became chaplain to Charles II. and in 1684 was inſtalled a canon of Windſor. He compiled *The Lives of the Primitive Fathers in the three firſt centuries of the church*, which is eſteemed a very uſeful work; and *Hiſtoria Literaria*, &c. in which he gives an exact account of all who had written for or againſt Chriſtianity, from the time of Chriſt to the 14th century: which works produced a warm controverſy between Dr Cave and M. Le Clerc, who was then writing his *Bibliotheque Univerſelle* in Holland, and who charged the doctor with partiality. Dr Cave died in 1713.

Cave, (Edward) printer, celebrated as the projector of the *Gentleman's Magazine*,—the firſt publication of the ſpecies, and ſince

The fruitful mother of a thouſand more,

who was born in 1691. His father being diſappointed of ſome ſmall family expectations, was reduced to follow the trade of a ſhoemaker at Rugby in Warwickſhire. The free ſchool of this place, in which his ſon had, by the rules of its foundation, a right to be inſtructed, was then in high reputation, under the Rev. Mr Holyock, to whoſe care moſt of the neighbouring families, even of the higheſt rank, entruſted their ſons. He had judgment

Cave. to discover, and for some time generosity to encourage the genius of young Cave; and was so well pleased with his quick progress in the school, that he declared his resolution to breed him for the university, and recommend him as a servitor to some of his scholars of high rank. But prosperity which depends upon the caprice of others, is of short duration. Cave's superiority in literature exalted him to an invidious familiarity with boys who were far above him in rank and expectations; and, as in unequal associations it always happens, whatever unlucky prank was played was imputed to Cave. When any mischief, great or small, was done, though perhaps others boasted of the stratagem when it was successful, yet upon detection or miscarriage, the fault was sure to fall upon poor Cave. The harsh treatment he experienced from this source, and which he bore for a while, made him at last leave the school, and the hope of a literary education, to seek some other means of gaining a livelihood.

He was first placed with a collector of the excise: but the insolence of his mistress, who employed him in servile drudgery, quickly disgusted him, and he went up to London in quest of a more suitable employment. He was recommended to a timber-merchant at the Bankside: and while he was there on liking, is said to have given hopes of great mercantile abilities: but this place he soon left, and was bound apprentice to Mr Collins, a printer of some reputation, and deputy alderman. This was a trade for which men were formerly qualified by a literary education, and which was pleasing to Cave, because it furnished some employment for his scholastic attainments. Here, therefore, he resolved to settle, though his master and mistress lived in perpetual discord, and their house was therefore no comfortable habitation. From the inconveniences of these domestic tumults he was soon released, having in only two years attained so much skill in his art, and gained so much the confidence of his master, that he was sent without any superintendant to conduct a printing-house at Norwich, and publish a weekly paper. In this undertaking he met with some opposition, which produced a public controversy, and procured young Cave the reputation of a writer.

His master died before his apprenticeship was expired, and he was not able to bear the perverseness of his mistress. He therefore quitted her house upon a stipulated allowance, and married a young widow with whom he lived at Bow. When his apprenticeship was over, he worked as a journeyman at the printing-house of Mr Barber, a man much distinguished and employed by the Tories, whose principles had at that time so much prevalence with Cave, that he was for some years a writer in Mist's Journal. He afterwards obtained by his wife's interest a small place in the post-office; but still continued, at his intervals of attendance, to exercise his trade, or to employ himself with some typographical business. He corrected the *Gradus ad Parnassum*: and was liberally rewarded by the company of stationers. He wrote an Account of the Criminals, which had for some time a considerable sale; and published many little pamphlets that accident brought into his hands, of which it would be very difficult to recover the memory. By the correspondence which his place in the post-office facilitated, he procured a country news-paper, and sold their intelligence to a journalist in London for a guinea a week. He was afterwards raised to the office of clerk of the franks, in which he acted with great spirit and firmness; and often stopped franks which were given by members of parliament to their friends, because he thought such extension of a peculiar right illegal. This raised many complaints; and the influence that was exerted against him procured his ejectment from office. He had now, however, collected a sum sufficient for the purchase of a small printing-office, and began the Gentleman's Magazine; an undertaking to which he owed the affluence in which he passed the last 20 years of his life, and the large fortune which he left behind him. When he formed the project, he was far from expecting the success which he found; and others had so little prospect of its consequence, that though he had for several years talked of his plan among printers and booksellers, none of them thought it worth the trial. That they were not (says Dr Johnson) restrained by their virtue from the execution of another man's design, was sufficiently apparent as soon as that design began to be gainful; for in a few years a multitude of magazines arose, and perished: only the London Magazine, supported by a powerful association of booksellers, and circulated with all the art and all the cunning of trade, exempted itself from the general fate of Cave's invaders, and obtained though not an equal yet a considerable sale.

Cave now began to aspire to popularity; and being a greater lover of poetry than any other art, he sometimes offered subjects for poems, and proposed prizes for the best performers. The first prize was 50l. for which, being newly acquainted with wealth, and thinking the influence of 50l. extremely great, he expected the first authors of the kingdom to appear as competitors; and offered the allotment of the prize to the universities. But when the time came, no name was seen among the writers that had been ever seen before; the universities and several private men rejected the province of assigning the prize. The determination was then left to Dr Cromwell Mortimer and Dr Birch; and by the latter the award was made, which may be seen in Gent. Mag. Vol. VI. p. 59.

Mr Cave continued to improve his Magazine, and had the satisfaction of seeing its success proportionate to his diligence, till in 1751 his wife died of an asthma. He seemed not at first much affected by her death, but in a few days lost his sleep and his appetite, which he never recovered. After having lingered about two years, with many vicissitudes of amendment and relapse, he fell by drinking acid liquors into a diarrhœa, and afterwards into a kind of lethargic insensibility; and died Jan. 10, 1754, having just concluded the 23d annual collection.

CAVEARE. See CAVIARE.

CAVEAT, in law, a kind of process in the spiritual courts, to stop the proving of a will, the granting tithes of administration, &c. to the prejudice of another. It is also used to stop the institution of a clerk to a benefice.

CAVEATING, in fencing, is the shifting the sword from one side of that of your adversary to the other.

CAVEDO, in commerce, a Portugueſe long meaſure, equal to $27\frac{354}{1000}$ Engliſh inches.

CAVENDISH, (Thomas) of Suffolk, the ſecond Engliſhman that ſailed round the globe, was deſcended from a noble family in Devonſhire. Having diſſipated his fortune, he reſolved to repair it at the expence of the Spaniards. He ſailed from Plymouth with two ſmall ſhips in July 1586; paſſed through the ſtraits of Magellan; took many rich prizes along the coaſts of Chili and Peru; and near California poſſeſſed himſelf of the St Ann, an Acapulco ſhip, with a cargo of immenſe value. He completed the circumnavigation of the globe, by returning home round the Cape of Good Hope, and reached Plymouth again in September 1588. On his arrival, it is ſaid, that his ſoldiers and ſailors were clothed in ſilk, his ſails were damaſk, and his topmaſt was covered with cloth of gold. His acquired riches did not laſt long: he reduced himſelf, in 1591, to the expedient of another voyage; which was far from being ſo ſucceſsful as the former; he went no farther than the ſtraits of Magellan, where the weather obliging him to return, he died of grief on the coaſt of Brazil.

Cavendish, (Sir William) deſcended of an ancient and honourable family, was born about the year 1505, the ſecond ſon of Thomas Cavendiſh, of Cavendiſh in Suffolk, clerk of the pipe in the reign of Henry VIII. Having had a liberal education, he was taken into the family of the great cardinal Woolſey, whom he ſerved in the capacity of gentleman-uſher of the chamber, when that ſuperb prelate maintained the dignity of a prince. In 1527, he attended his maſter on his ſplendid embaſſy to France, returned with him to England, and was one of the few who continued faithful to him in his diſgrace. Mr Cavendiſh was with him when he died, and delayed going to court till he had performed the laſt duty of a faithful ſervant by ſeeing his body decently interred. The king was ſo far from diſapproving of his conduct, that he immediately took him into his houſehold, made him treaſurer of his chamber, a privy-counſellor, and afterwards conferred on him the order of knighthood. He was alſo appointed one of the commiſſioners for taking the ſurrender of religious houſes. In 1540 he was nominated one of the auditors of the court of augmentations, and ſoon after obtained a grant of ſeveral conſiderable lordſhips in Hertfordſhire. In the reign of Edward VI. his eſtates were much increaſed by royal grants in ſeven different counties: and he appears to have continued in high favour at court during the reign of queen Mary. He died in the year 1557. He was the founder of Chatſworth, and anceſtor of the dukes of Devonſhire. He wrote "The life and death of cardinal Woolſey:" printed at London 1667; reprinted in 1706, under the title of "Memoirs of the great favourite cardinal Woolſey."

Cavendish, (William) duke of Newcaſtle, grandſon of Sir William Cavendiſh, was born in 1592. In 1610, he was made knight of the bath; in 1620, raiſed to the dignity of a peer, by the title of baron Ogle, and Viſcount Mansfield; and in the third year of king Charles I. created earl of Newcaſtle upon Tyne, and baron Cavendiſh of Boleſover. He was after this made governor to the prince of Wales, afterwards Charles II. When the firſt troubles broke out in Scotland, and the king's treaſury was but indifferently provided, he contributed ten thouſand pounds; and alſo raiſed a troop of horſe, conſiſting of about two hundred knights and gentlemen, who ſerved at their own charge, were commanded by the earl, and honoured with the title of *the prince's troop*. He had after this the command of the northern counties; and was conſtituted general and commander in chief of all the forces that might be raiſed north of Trent, and of ſeveral counties ſouth of that river. He afterwards raiſed an army of eight thouſand horſe, foot, and dragoons; with which he took ſome towns, and gained ſeveral important victories. On this he was advanced to the dignity of marquis of Newcaſtle: but his majeſty's affairs being totally ruined by the raſhneſs of prince Rupert, he, with a few of the principal officers of the army, went abroad, and ſtaid for ſome time at Paris; where, notwithſtanding the vaſt eſtate he had when the civil war broke out, his circumſtances were now ſo bad, that himſelf and wife were reduced to the neceſſity of pawning their clothes for a dinner. He afterwards removed to Antwerp, that he might be nearer his own country; and there, though under great difficulties, reſided for ſeveral years: but, notwithſtanding his diſtreſſes, he was treated, during an exile of eighteen years, with extraordinary marks of diſtinction. On his return to England at the reſtoration, he was advanced to the dignity of earl of Ogle and duke of Newcaſtle. He ſpent his time in a country retirement, and was the patron of men of merit. His grace died in 1679, aged 84. He wrote a treatiſe on horſemanſhip, which is eſteemed: and ſome comedies, which are not.

Mr Granger obſerves, that he was maſter of many accompliſhments, and was much better qualified for a court than a camp: that he underſtood horſemanſhip, muſic, and poetry; but was a better horſeman than muſician, and a better muſician than poet.

Cavendish, (Margaret) ducheſs of Newcaſtle, famous for her voluminous productions, was born about the latter end of the reign of James I. and was the youngeſt ſiſter of Lord Lucas of Colcheſter. She married the duke of Newcaſtle abroad in 1645; and on their return after the reſtoration, ſpent the remainder of her life in writing plays, poems, with the life of her huſband, to the amount of about a dozen of folios. "What gives the beſt idea of her unbounded paſſion for ſcribbling (ſays Mr Walpole), was her ſeldom reviſing the copies of her works, leſt, as ſhe ſaid, it ſhould diſturb her following conceptions." She died in 1673.

Cavendish, (William) the firſt duke of Devonſhire, and one of the moſt diſtinguiſhed patriots in the Britiſh annals, was born in 1640. In 1677, being then member for Derby, he vigorouſly oppoſed the venal meaſures of the court; and, the following year, was one of the committee appointed to draw up articles of impeachment againſt the lord treaſurer Danby. In 1679, being re-elected to ſerve for Derby in a new parliament, Charles II. thought fit to make him a privy counſellor; but he ſoon withdrew from the board, with his friend lord Ruſſel, when he found that popiſh intereſt prevailed. He carried up the articles of impeachment to the houſe of lords, againſt lord chief juſtice Scroggs, for his arbitrary and illegal proceedings in the court of king's bench; and when the king declared his resolution not to sign the bill for excluding the Duke of York (afterwards James II.), he moved the house of commons, that a bill might be brought in for the association of all his majesty's protestant subjects. He also openly named the king's evil counsellors, and voted for an address to remove them from his presence and councils for ever. He nobly appeared at lord Russel's trial, in defence of that great man, at a time when it was scarce more criminal to be an accomplice than a witness for him. The same fortitude, activity, and love of his country, animated this illustrious patriot to oppose the arbitrary proceedings of James II.; and when he saw there was no other method of saving the nation from impending slavery, he was the foremost in the association for inviting over the prince of Orange, and the first nobleman who appeared in arms to receive him at his landing. He was created Duke of Devonshire in 1694, by William and Mary. His last public service was in the union with Scotland, for concluding of which he was appointed a commissioner by queen Anne. He died in 1707, and ordered the following inscription to be put on his monument.

*Willielmus Dux Devon,*
*Bonorum Principum Fidelis Subditus,*
*Inimicus et Invisus Tyrannis.*
William Duke of Devonshire,
Of good Princes the faithful Subject,
The Enemy and Aversion of Tyrants.

Besides being thus estimable for public virtues, his grace was distinguished by his literary accomplishments. He had a poetical genius, which showed itself particularly in two pieces, written with equal spirit, dignity, and delicacy: these are, an ode on the death of queen Mary; and an allusion to the archbishop of Cambray's supplement to Homer. He had great knowledge in the languages, was a true judge in history, and a critic in poetry; he had a fine hand in music, an elegant taste in painting, and in architecture had a skill equal to any person of the age in which he lived. His predecessor, Sir John Cavendish, was the person who killed the famous Watt Tyler in 1381.

CAVETTO, in architecture, a hollow member, or round concave moulding, containing a quadrant of a circle, and having a quite contrary effect to that of a quarter round: it is used as an ornament in cornices.

CAVEZON, in the manege, a sort of nose-band, either of iron, leather, or wood, sometimes flat, and at other times hollow or twisted, clapt upon the nose of a horse to wring it, and so forward the suppling and breaking of the horse.

CAVIARE, a kind of food lately introduced into Britain. It is made of the hard roes of sturgeon *, formed into small cakes, about an inch thick and three or four inches broad. The method of making it is by taking out of the spawn all the nerves or strings, then washing it in white-wine or vinegar, and spreading it on a table. It is then salted and pressed in a fine bag; after which it is cased up in a vessel with a hole at the bottom, that if any moisture is left it may run out. This kind of food is in great request among the Moscovites, on account of their three lents, which they keep with a superstitious exactness; wherefore the Italians settled at Moscow drive a very great trade in this commodity throughout that empire, there being

* See *Acipenser.*



a prodigious quantity of sturgeon taken at the mouth of the Wolga and other rivers which fall into the Caspian sea. A pretty large quantity of the commodity is also consumed in Italy and France. They get the caviare from Archangel, but commonly buy it at second hand of the English and Dutch.—According to Savary, the best caviare brought from Muscovy is prepared from the belluga, a fish eight or ten feet long, caught in the Caspian sea, which is much preferable to that made of the spawn of sturgeon. A kind of caviare, or rather sausage, is also made from the spawn of some other fishes; particularly a sort of mullet caught in the Mediterranean. See Mugil and Botargo.

*Insect Caviare.* See Axayacatl.

CAVIDOS. See Cabidos.

CAVIL, (*cavillatio*) is defined by some a fallacious kind of reason, carrying some resemblance of truth, which a person, knowing its falsehood, advances in dispute for the sake of victory. The art of framing sophisms or fallacies is called by Boethius *cavillatoria.*

CAUK, or Cawk. See Terra Ponderosa, and Chemistry, *Index.*

CAUKING, or Caulking, *of a ship*, is driving a quantity of oakum, or old ropes untwisted and drawn asunder, into the seams of the planks, or into the intervals where the planks are joined together in the ship's decks or sides, in order to prevent the entrance of water. After the oakum is driven very hard into these seams, it is covered with hot and melted pitch or rosin, to keep the water from rotting it.

Among the ancients, the first who made use of pitch in caulking, were the inhabitants of Phœacia, afterwards called Corsica. Wax and rosin appear to have been commonly used previous to that period; and the Poles at this time use a sort of unctuous clay for the same purpose, on their navigable rivers.

*Caulking-Irons*, are iron chissels for that purpose. Some of these irons are broad, some round, and others grooved. After the seams are stopped with oakum, it is done over with a mixture of tallow, pitch, and tar, as low as the ship draws water.

CAUL, in anatomy, a membrane in the abdomen, covering the greatest part of the guts; called, from its structure, *Reticulum*, but most frequently *Omentum.* See Anatomy, n° 90.

Caul is likewise a little membrane, found on some children, encompassing the head when born.

Drelincourt takes the *caul* to be only a fragment of the membranes of the fœtus; which ordinarily break at the birth of the child. Lampridius tells us, that the midwives sold this *caul* at a good price to the advocates and pleaders of his time; it being an opinion, that while they had this about them, they should carry with them a force of persuasion which no judge could withstand: the canons forbid the use of it; because some witches and sorcerers, it seems, had abused it.

CAULIFLOWERS, in gardening, a much esteemed species of cabbage. See Brassica.

CAURIS, in natural history, a name given by some to the genus of shells called, by the generality of writers, *porcellana*, and *concha venerea.* It is from a false pronunciation of this word *cauris* that we call these shells *gowries.* See *Porcelain-Shell.*

CAURSINES, (*Coursini*) were Italians that came into England about the year 1235, terming themselves

Caursa ‖ Cause.

*the Pope's merchants*, but driving no other trade than letting out money; and having great banks in England, they differed little from Jews, save (as history says) they were rather more merciless to their debtors. Some will have them called *Coursines*, quasi *Causa Ursini*, bearish and cruel in their causes; others *Caorsini* or *Corsini*, as coming from the isle of Corsica; but Cowel says, they have their name from *Caorsium, Caorsi*, a town in Lombardy, where they first practised their arts of usury and extortion; from whence, spreading themselves, they carried their infamous trade through most parts of Europe, and were a common plague to every nation where they came. The then bishop of London excommunicated them; and king Henry III. banished them from his kingdom in the year 1240. But, being the pope's solicitors and money-changers, they were permitted to return in the year 1250; tho' in a very short time they were again driven out of the kingdom on account of their intolerable exactions.

CAUSA MATRIMONII PRÆLOCUTI, in common law, a writ that lies where a woman gives land to a man in fee to the intent he shall marry her, and he refuses to do it in a reasonable time, being thereunto required by the woman; and in such case, for not performing the condition, the entry of the woman into the lands again has been adjudged lawful.

The husband and wife may sue this writ against another who ought to have married her.

CAUSALITY, among metaphysicians, the action or power of a cause in producing its effect.

CAUSALTY, among miners, denotes the lighter, sulphureous, earthy parts of ores, carried off in the operation of washing. This, in the mines, they throw in heaps upon banks, which in six or seven years they find it worth their while to work over again.

CAUSE, that from whence any thing proceeds, or by virtue of which any thing is done: it stands opposed to effect. We get the ideas of cause and effect from our observation of the vicissitude of things, while we perceive some qualities or substances begin to exist, and that they receive their existence from the due application and operation of other beings. That which produces, is the cause; and that which is produced, the effect: thus, fluidity in wax is the effect of a certain degree of heat, which we observe to be constantly produced by the application of such heat.

*Reid on the Active Powers of Man.*

Aristotle, and the schoolmen after him, distinguished four kinds of causes; the efficient, the material, the formal, and the final. This, like many of Aristotle's distinctions, is only a distinction of the various meanings of an ambiguous word; for the efficient, the matter, the form, and the end, have nothing common in their nature, by which they may be accounted species of the same *genus*; but the Greek word, which we translate *cause*, had these four different meanings in Aristotle's days, and we have added other meanings. We do not indeed call the matter or the form of a thing its cause; but we have final causes, instrumental causes, occasional causes, and many others. Thus the word *cause* has been so hackneyed, and made to have so many different meanings in the writings of philosophers, and in the discourse of the vulgar, that its original and proper meaning is lost in the crowd.

With regard to the phenomena of nature, the important end of knowing their causes, besides gratifying our curiosity, is, that we may know when to expect them, or how to bring them about. This is very often of real importance in life; and this purpose is served, by knowing what, by the course of nature, goes before them and is connected with them; and this, therefore, we call the *cause* of such a phenomenon.

If a magnet be brought near to a mariner's compass, the needle, which was before at rest, immediately begins to move, and bends its course towards the magnet, or perhaps the contrary way. If an unlearned sailor is asked the cause of this motion of the needle, he is at no loss for an answer. He tells you it is the magnet: and the proof is clear; for, remove the magnet, and the effect ceases; bring it near, and the effect is again produced. It is, therefore, evident to sense, that the magnet is the cause of this effect.

A Cartesian philosopher enters deeper into the cause of this phenomenon. He observes, that the magnet does not touch the needle, and therefore can give it no impulse. He pities the ignorance of the sailor. The effect is produced, says he, by magnetic effluvia, or subtile matter, which passes from the magnet to the needle, and forces it from its place. He can even show you, in a figure, where these magnetic effluvia issue from the magnet, what round they take, and what way they return home again. And thus he thinks he comprehends perfectly how, and by what cause, the motion of the needle is produced.

A Newtonian philosopher inquires what proof can be offered for the existence of magnetic effluvia, and can find none. He therefore holds it as a fiction, a hypothesis; and he has learned that hypotheses ought to have no place in the philosophy of nature. He confesses his ignorance of the real cause of this motion, and thinks that his business as a philosopher is only to find from experiment the laws by which it is regulated in all cases.

These three persons differ much in their sentiments with regard to the real cause of this phenomenon; and the man who knows most is he who is sensible that he knows nothing of the matter Yet all the three speak the same language, and acknowledge that the cause of this motion is the attractive or repulsive power of the magnet.

What has been said of this, may be applied to every phenomenon that falls within the compass of natural philosophy. We deceive ourselves, if we conceive that we can point out the real efficient cause of any one of them.

The grandest discovery ever made in natural philosophy, was that of the law of gravitation, which opens such a view of our planetary system, that it looks like something divine. But the author of this discovery was perfectly aware that he discovered no real cause, but only the law or rule according to which the unknown cause operates.

Natural philosophers, who think accurately, have a precise meaning to the terms they use in the science; and when they pretend to show the cause of any phenomenon of nature, they mean by the cause, a law of nature of which that phenomenon is a necessary consequence.

The whole object of natural philosophy, as Newton expresly teaches, is reducible to these two heads: first, by just induction from experiment and observation, to discover

Caufe, Caufeway.

difcover the laws of nature; and then to apply thofe laws to the folution of the phenomena of nature. This was all that this great philofopher attempted, and all that he thought attainable. And this indeed he attained in a great meafure, with regard to the motions of our planetary fyftem, and with regard to the rays of light.

But fuppofing that all the phenomena which fall within the reach of our fenfes were accounted for from general laws of nature juftly deduced from experience; that is, fuppofing natural philofophy brought to its utmoft perfection; it does not difcover the efficient caufe of any one phenomenon in nature.

The laws of nature are the rules according to which the effects are produced; but there muft be a caufe which operates according to thefe rules. The rules of navigation never navigated a fhip. The rules of architecture never built a houfe.

Natural philofophers, by great attention to the courfe of nature, have difcovered many of her laws, and have very happily applied them to account for many phenomena: but they have never difcovered the efficient caufe of any one phenomenon; nor do thofe who have diftinct notions of the principles of the fcience make any fuch pretence.

Upon the theatre of nature we fee innumerable effects, which require an agent endowed with active power; but the agent is behind the fcene. Whether it be the Supreme Caufe alone, or a fubordinate caufe or caufes; and if fubordinate caufes be employed by the Almighty, what their nature, their number, and their different offices may be; are things hid, for wife reafons, without doubt, from the human eye.

Cause, among civilians, the fame with action. See Action.

Cause, among phyficians. The caufe of a difeafe is defined by Galen to be that during the prefence of which we are ill, and which being removed the diforder immediatey ceafes. The doctrine of the caufes of difeafes is called Etiology.

Phyficians divide caufes into procatarctic, antecedent, and continent.

*Procatarctic Cause* αιτια προκαταρκτικη, called alfo *primitive* and *incipient caufe*, either an occafion which of its own nature does not beget a difeafe, but happening on a body inclined to difeafes, breeds a fever, gout, *&c.* (fuch as are watching, fafting and the like); or an evident and manifeft caufe, which immediately produces the difeafe, as being fufficient thereto, fuch as is a fword in refpect of a wound.

*Antecedent Cause*, αιτια προηγεμενη, a latent difpofition of the body, from whence fome difeafe may arife; fuch as a plethora in refpect of a fever, a cacochymia in refpect of a fcurvy.

*Continent, Conjunct*, or *Proximate Cause*, that principle in the body which immediately adheres to the difeafe, and which being prefent, the difeafe is alfo prefent; or, which being removed, the difeafe is taken away: fuch is the ftone in a nephritic patient.

CAUSEWAY, or Causey, a maffive conftruction of ftone, ftakes, and fafcines; or an elevation of fat, vifcous earth, well beaten; ferving either as a road in wet marfhy places or as a mole to retain the waters of a pond or prevent the river from overflowning the lower ground. See Road.—The word comes from the French *Chauffee*, anciently wrote *Chaulfee;* and that from the Latin *Calceata*, or *Calcata;* according to Somner and Spelman, *a calcando*. Bergier rather takes the word to have had its rife *à peditum calceis, quibus teruntur*. Some derive it from the Latin *calx*, or French *chaux*, as fuppofing it primarily to denote a way paved with chalk-ftones.

Causeway, Caufticity.

Causeway, *calcetum*, or *calcea*, more ufually denotes a common hard raifed way, maintained and repaired with ftones and rubbifh.

*Devil's Causeway*, a famous work of this kind, which ranges through the county of Northumberland in England, commonly fuppofed to be Roman, though Mr Horfley fufpects it to be of later times.

*Giant's Causeway*, is a denomination given to a huge pile, of ftony columns in the diftrict of Coleraine in Ireland. See *Giant's Caufeway*.

CAUSSIN, (Nicholas) furnamed the Juft, a French Jefuit, was born at Troyes in Champagne, in the year 1580; and entered into the Jefuits order when he was 26 years of age. He taught rhetoric in feveral of their colleges, and afterwards began to preach by which he gained very great reputation. He increafed this reputation by publifhing books, and in time was preferred to be confeffor to the king. But he did not difcharge this office to the fatisfaction of Cardinal Richelieu, though he difcharged it to the fatisfaction of every honeft man; and therefore, it is not to be wondered at that he came at length to be removed. He died in the Jefuits convent at Paris in 1651. None of his works did him more honour than that which he entitled *La Cour Sainte*. It has been printed a great many times; and tranflated into Latin, Italian, Spanifh, Portuguefe, German, and Englifh. He publifhed feveral other books both in Latin and French.

CAUSTICITY, a quality belonging to feveral fubftances, by the acrimony of which the parts of living animals may be corroded and deftroyed. Bodies which have this quality, when taken internally, are true poifons. The caufticity of fome of thefe, as of arfenic, is fo deadly, that even their external ufes is profcribed by prudent phyficians. Several others as nitrous acid, lapis infernalis or lunar cauftic, common cauftic, butter of antimony, are daily and fuccefsfully ufed to confume fungous flefh, to open iffues, *&c.* They fucceed very well when properly employed and fkilfully managed.

The caufticity of bodies depends entirely on the ftate of the faline, and chiefly of the acid, matters they contain. When thefe acids happen to be at the fame time much concentrated, and flightly attached to the matters with which they are combined, they are then capable of acting, and are corrofive or cauftic. Thus fixed and volatile alkalies, although they are themfelves cauftic, become much more fo by being treated with quicklime; becaufe this fubftance deprives them of much fat an inflammable matter, and all their fixed air, which binds and reftrains the action of their faline principle. By this treatment, then the faline principle is more difengaged, and rendered more capable of action. Alfo all combinations of metallic matters with acids form falts more or lefs corrofive, becaufe thefe acids are deprived of all their fuperabundant water, and are befides but imperfectly faturated with the metallic matters. Neverthelefs, fome other circumftance is neceffary to conftitute the caufticity of thefe faline metalline metaline matters. For the same quantity of marine acid, which, when pure and diluted with a certain quantity of water, would be productive of no harm, shall, however, produce all the effects of a corrosive poison, when it is united with mercury in *corrosive sublimate*, although the sublime shall be dissolved in so much water that its causticity cannot be attributed to the concentration of its acid. This effect is, by some chemists, attributed to the great weight of the metallic matters with which the acid is united: and this opinion is very probable, seeing its causticity is nothing but its dissolving power, or its disposition to combine with other bodies; and this disposition is nothing else than attraction.

On this subject Dr Black observes, that the compounds produced by the union of the metals with acids are in general corrosive. Many of them applied to the skin destroy it almost as fast as the mineral acids; and some of the most powerful potential cauteries are made in this way. Some are reckoned more acrid than the pure acids themselves; and they have more powerful effects when taken internally, or at least seem to have. Thus we can take 10 or 12 drops of a fossil acid, diluted with water, without being disturbed by it; but the same quantity of acid previously combined with silver, quicksilver, copper, or regulus of antimony, will throw the body into violent disorders, or even prove a poison, if taken all at once.

This increased activity was, by the mechanical philosophers, supposed to arise from the weight of the metallic particles. They imagined that the acid was composed of minute particles of the shape of needles or wedges; by which means they were capable of entering the pores of other bodies, separating their atoms from each other, and thus dissolving them. To these acid spiculæ the metallic particles gave more force; and the momentum of each particular needle or wedge was increased in proportion to its increase of gravity by the additional weight of the metallic particle. But this theory is entirely fanciful, and does not correspond with facts. The activity of the compound is not in proportion to the weight of the metal: nor are the compounds always possessed of any great degree of acrimony: neither is it true that any of them have a greater power of destroying animal substances than the pure acids have.

There is a material difference between the powers called *stimuli* and *corrosives*. Let a person apply to any part of the skin a small quantity of lunar caustic, and likewise a drop of strong nitrous acid, and he will find that the acid acts with more violence than the caustic; and the disorders that are occasioned by the compounds of metals and acids do not proceed from a *causticity* in them, but from the metal affecting and proving a stimulus to the nerves: and that this is the case, appears from their affecting some particular nerves of the body. Thus the compounds of regulus of antimony and mercury with the vegetable acids, do not show the smallest degree of acrimony; but, taken internally, they produce violent convulsive motions over the whole body, which are occasioned by the metallic matter having a power of producing this effect; and the acid is only the means of bringing it into a dissolved state, and making it capable of acting on the nervous system. In general, however, the compounds of metallic substances with acids may be considered as milder than the acids in a separate state; but the acid is not so much neutralized as in other compounds, for it is less powerfully attracted by the metal; so that alkaline salts, absorbent earths, or even heat alone, will decompound them; and some of the inflammable substances, as spirit of wine, aromatic oils, &c. will attract the acid, and precipitate the metal in its metallic form; and the metals can be employed to precipitate one another in their metallic form; so that the cohesion of these compounds is much weaker than those formed of the same acids with alkaline salts or earths.

CAUSTICS, in physics, an appellation given to medicines of so hot and fiery a nature, that, being applied, consume, and as it were burn, the texture of the parts, like hot iron.

Caustics are generally divided into four sorts; the common strong caustic, the common milder caustic, the antimonial caustic, and the lunar caustic. See PHARMACY and CHEMISTRY.

*CAUSTIC Curve*, in the higher geometry, a curve formed by the concourse or coincidence of the rays of light reflected from some other curve.

CAUSUS, or BURNING FEVER, a species of continual fever, accompanied with a remarkable inflammation of the blood.

CAUTERIZATION, the act of burning or searing some morbid part, by the application of fire either actual or potential. In some places they cauterize with burning tow, in others with cotton or moxa, in others with live coals; some use Spanish wax, others pyramidal pieces of linen, others gold or silver: but Severinus recommends flame blown through a pipe; but what is usually preferred among us is a hot iron.

Cauterizing irons are of various figures; some flat, others round, some curved, *&c.* of all which we find draughts in Albucasis, Scultetus, and Ferrara, and others. Sometimes a cautery is applied through a capsula, to prevent any terror from the sight of it. This method was invented by Placentinus, and is described by Scultetus. In the use of all cauteries, care is to be taken to defend the neighbouring parts, either by a lamina, defensive plaster, or lint moistened in oxyerate. Sometimes the hot iron is transmitted through a copper cannula, for the greater safety of the adjoining parts. The degrees and manners of cauterizing are varied according to the nature of the disease and the part affected.

CAUTERY, in surgery, a medicine for burning, eating, or corroding any solid part of the body.

Cauteries are distinguished into two classes; actual and potential: by actual cauteries are understood red hot instruments, usually of iron; and by potential cauteries are understood certain kinds of corroding medicines. See PHARMACY.

CAUTION, in the civil and Scots law, denotes much the same with what, in the law of Engand, is called BAIL.

CAUTIONER, in Scots law, that person, who becomes bound for another to the performance of any deed or obligation. As to the different kinds and effects of Cautionry, see LAW, Part III. N° clxxv. 19.

CAWK. See CAUK.

CAXA, a little coin made of lead mixed with some scoria of copper, struck in China, but current chiefly at Bantam in the island of Java, and some of the neighbouring islands. See (the *Table* subjoined to) MONEY.

CAXAMALCA, the name of a town and district of Peru in South-America, where there was a most sumptuous palace belonging to the Incas, and a magnificent temple dedicated to the sun.

CAXTON, (William) a mercer of London, eminent by the works he published, and for being *reputed* the first who introduced and practised the art of printing in England: as to which, see (*the History of*) PRINTING.

CAYENNE, a rich town and island in South-America, and capital of the French settlements there, is bounded on the north by the Dutch colonies of Surinam, and situated in W. Long. 53. 10. N. Lat. 5. 0.

This settlement was begun in 1635. A report had prevailed for some time before, that, in the interior parts of Guiana, there was a country known by the name of *del Dorado*, which contained immense riches in gold and precious stones; more than ever Cortez and Pizarro had found in Mexico and Peru; and this fable had fired the imagination of every nation in Europe. It is supposed that this was the country in quest of which Sir Walter Raleigh went on his last voyage; and, as the French were not behind their neighbours in their endeavours to find out so desirable a country, some attempts, for this purpose, were likewise made by that nation much about the same time; which at last coming to nothing, the adventurers took up their residence on the island of Cayenne. In 1643, some merchants of Rouen united their stock, with a design to support the new colony; but, committing their affairs to one Poncet de Bretigny, a man of a ferocious disposition, he declared war both against the colonists and savages, in consequence of which he was soon massacred. This catastrophe entirely extinguished the ardour of these associates; and in 1651 a new company was established. This promised to be much more considerable than the former; and they set out with such a capital as enabled them to collect 700 or 800 colonists in the city of Paris itself. These embarked on the Seine, in order to sail down to Havre de Grace; but unfortunately the Abbe de Marivault, a man of great virtue, and the principal promoter of the undertaking, was drowned as he was stepping into his boat. Another gentleman, who was to have acted as general, was assassinated on his passage; and 12 of the principal adventurers, who had promised to put the colony into a flourishing situation, not only were the principal perpetrators of this fact, but uniformly behaved in the same attrocious manner. At last they hanged one of their own number; two died; three were banished to a desert island; and the rest abandoned themselves to every kind of excess. The commandant of the citadel deserted to the Dutch with part of his garrison. The savages, roused by numberless provocations, fell upon the remainder; so that the few who were left thought themselves happy in escaping to the Leeward Islands in a boat and two canoes, abandoning the fort, ammunition, arms, and merchandise, fifteen months after they had landed on the island.

In 1663, a new company was formed, whose capital amounted only to L.8750. By the assistance of the ministry they expelled the Dutch, who had taken possession of the island, and settled themselves much more comfortably than their predecessors. In 1667 the island was taken by the English, and in 1676 by the Dutch, but afterwards restored to the French; and since that time it never has been attacked. Soon after some pirates, laden with the spoils they had gathered in the South Seas, came and fixed their residence at Cayenne; resolving to employ the treasures they had acquired in the cultivation of the lands. In 1688, Ducasse, an able seaman, arrived with some ships from France, and proposed to them the plundering of Surinam. This proposal exciting their natural turn for plunder, the pirates betook themselves to their old trade, and almost all the rest followed their example. The expedition, however, proved unfortunate. Many of the assailants were killed, and all the rest taken prisoners and sent to the Caribbee Islands. This loss the colony has never yet recovered.



The island of Cayenne is about 16 leagues in circumference, and is only parted from the continent by two rivers. By a particular formation, uncommon in islands, the land is highest near the water side, and low in the middle. Hence the land is so full of morasses, that all communication between the different parts of it is impossible, without taking a great circuit. There are some small tracts of an excellent soil to be found here and there; but the generality is dry, sandy, and soon exhausted. The only town in the colony is defended by a covert way, a large ditch, a very good mud rampart and five bastions. In the middle of the town is a pretty considerable eminence, of which a redoubt has been made that is called the *fort*. The entrance into the harbour is through a narrow channel; and ships can only get in at high water through the rocks and reefs that are scattered about this pass.

The first produce of Cayenne was the arnotto; from the produce of which, the colonists proceeded to that of cotton, indigo, and lastly sugar. It was the first of all the French colonies that attempted to cultivate coffee. The coffee-tree was brought from Surinam in 1721, by some deserters from Cayenne, who purchased their pardon by so doing. Ten or twelve years after they planted cocoa. In the year 1752, there were exported from Cayenne 260,541 pounds of arnotto, 80,363 pounds of sugar, 17,919 pounds of cotton, 26,881 pounds of coffee, 91,916 pounds of cocoa, 618 trees for timber, and 104 planks.

CAYLUS, (Count de) Marquis de Sternay, Baron de Bransac, was born at Paris in 1692. He was the eldest of the two sons of John count de Caylus, lieutenant-general of the armies of the king of France, and of the Marchioness de Villete. The count and countess his father and mother, were very careful of the education of their son. The former instructed him in the profession of arms, and in bodily exercises: the latter watched over and fostered the virtues of his mind; and this delicate task she discharged with singular success. The countess was the niece of Madam de Maintenon, and was remarkable both for the solidity of her understanding and the charms of her wit. She was the author of that agreeable book intitled, "The Recollections of Madam de Caylus," of which Voltaire lately published an elegant edition. The amiable qualities of the mother appeared in the son; but they appeared with a bold and military

Caylus. litary air. In his natural temper he was gay and ſprightly, had a taſte for pleaſure, a ſtrong paſſion for independenee, and an invincible averſion to the ſervitude of a court. Such were the inſtructors of the count de Caylus. He was only twelve years of age when his father died at Bruſſels in 1704. After finiſhing his exerciſes, he entered into the corps of the *Mouſquetoires;* and in his firſt campaign in the year 1709, he diſtinguiſhed himſelf by his valour in ſuch a manner, that Louis XIV. commended him before all the court, and rewarded him with an enſigncy in the *Gendarmerie*. In 1711 he commanded a regiment of dragoons, which was called by his own name; and he ſignalized hinſelf at the head of it in Catalonia. In 1713, he was at the ſiege of Fribourg, where he was expoſed to imminent danger in the bloody attack of the covered way. The peace of Raſtade having left him in a ſtate of inactivity ill-ſuited to his natural temper, his vivacity ſoon carried him to travel into Italy; and his curioſity was greatly excited by the wonders of that country, where antiquity is ſtill fruitful, and produces ſo many objects to improve taſte and to excite admiration. The eyes of the count were not yet learned; but he was ſtruck with the ſight of ſo many beauties, and ſoon became acquainted with them. After a year's abſence, he returned to Paris with ſo ſtrong a paſſion for travelling, and for antiquities, as induced him to quit the army.

He had no ſooner quitted the ſervice of Louis, than he ſought for an opportunity to ſet out for the Levant. When he arrived at Smyrna, he viſited the ruins of Epheſus. From the Levant he was recalled in February 1717 by the tenderneſs of his mother. From that time he left not France, but to make two excurſions to London. The academy of painting and ſculpture adopted him an honorary member in the year 1731; and the count, who loved to realize titles, ſpared neither his labour, nor his credit, nor his fortune, to inſtruct, aſſiſt, and animate the artiſts. He wrote the lives of the moſt celebrated painters and engravers that have done honour to this illuſtrious academy; and, in order to extend the limits of the art, which ſeemed to him to move in too narrow a circle, he collected, in three different works, new ſubjects for the painter, which he had met with in the works of the ancients.

Such was his paſſion for antiquity, that he wiſhed to have had it in his power to bring the whole of it to life again. He ſaw with regret, that the works of the ancient painters, which have been diſcovered in our times, are effaced and deſtroyed almoſt as ſoon as they are drawn from the ſubterraneous manſions where they were buried. A fortunate accident furniſhed him with the means of ſhewing us the compoſition and the colouring of the pictures of ancient Rome. The coloured drawings which the famous Pietro Sante Bartoli had taken there from antique pictures, fell into his hands. He had them engraved; and, before he enriched the king of France's cabinet with them, he gave an edition of them at his own expence. It is perhaps the moſt extroardinary book of antiquities that ever will appear. The whole is painted with a purity and a preciſion that are inimitable: we ſee the livelineſs and the freſhneſs of the colouring that charmed the Cæſars. There were only 30 copies publiſhed; and there is no reaſon to expect that there will hereafter be any more.

Count de Caylus was engaged at the ſame time in an enterprize ſtill more favourable to Roman grandeur, and more intereſting to the French nation. Colbert had framed the deſign of engraving the Roman antiquities that are ſtill to be ſeen in the ſouthern provinces of France. By his orders Mignard the architect had made drawings of them, which count de Caylus had the good fortune to recover. He reſolved to finiſh the work begun by Colbert, and to dedicate it to that great miniſter; and ſo much had he this enterpriſe at heart, that he was employed in it during his laſt illneſs, and warmly recommended it to M. Mariette.

In 1742, Count Caylus was admitted honorary member of the academy of belles lettres; and then it was that he ſeemed to have found the place for which nature deſigned him. The ſtudy of literature now became his ruling paſſion; he conſecrated to it his time and his fortune; he even renounced his pleaſures to give himſelf wholly up to that of making ſome diſcovery in the field of antiquity. But amidſt the fruits of his reſearch and invention, nothing ſeemed more flattering to him than his diſcovery of encauſtic painting. A deſcription of Pliny's, but too conciſe a one to give him a clear view of the matter, ſuggeſted the idea of it. He availed himſelf of the friendſhip and ſkill of M. Magault, a phyſician in Paris, and an excellent chemiſt; and by repeated experiments found out the ſecret of incorporating wax with divers tints and colours, and of making it obedient to the pencil. Pliny has made mention of two kinds of encauſtic painting practiſed by the ancients; one of which was performed with wax, and the other upon ivory, with hot punches of iron. It was the former that Count Caylus had the merit of reviving; and M. Muntz afterwards made many experiments to carry it to perfection.

In the hands of Count Caylus, literature and the arts lent each other a mutual aid. But it would be endleſs to give an account of all his works. He publiſhed above 40 diſſertations in the Memoirs of the Academy of Belles Lettres. The artiſts he was particularly attentive to; and to prevent their falling into miſtakes from an ignorance of coſtume, which the ableſt of them have ſometimes done, he founded a prize of 500 livres, the object of which is to explain, by means of authors and monuments, the uſages of ancient nations. In order that he might enjoy with the whole world the treaſures he had collected, he cauſed them to be engraved, and gave a learned deſcription of them in a work which he embelliſhed with 800 copperplates.

The ſtrengh of his conſtitution ſeemed to give him hopes of a long life: but a humour ſettling in one of his legs, which entirely deſtroyed his health, he expired on the 5th of September 1765, and by his death his family is extinct. The tomb erected to the honour of count Caylus is to be ſeen in the chapel of St Germain-l'Auxerrois, and deſerves to be remarked. It is perfectly the tomb of an antiquary. This monument was an ancient ſepulchral antique, of the moſt beautiful porphyry, with ornaments in the Egyptian taſte. From the moment he procured it, he had

had destined it to grace the place of his interment. While he awaited the fatal hour, he placed it in his garden, where he used to look upon it with a tranquil but thoughtful eye, and pointed it out to the inspection of his friends.

The character of Count Caylus is to be traced in the different occupations which divided his cares and his life. In society he had all the frankness of a soldier, and a politeness which had nothing in it of deceit or circumvention. Born independent, he applied to studies which suited his taste. His heart was yet better than his abilities. In his walks he used frequently to try the honesty of the poor by sending them with a piece of money to get change for him. In these cases he enjoyed their confusion at not finding him; and then presenting himself, used to commend their honesty, and give them double the sum. He said frequently to his friends, "I have this day lost a crown; but I was sorry that I had not an opportunity of giving a second. The beggar ought not to want integrity."

CAYSTER, or CAYSTRUS, (anc. geog.) a river of Ionia, whose mouth Ptolemy places between Colophon and Ephesus; commended by the poets for its swans, which it had in great numbers. Its source was in the Montes Cilbiani, (Pliny). *Caystrius Campus* was a part of the territory of Ephesus. *Campi Caystriani* of Lydia, were the plains lying in the middle between the inland parts and mount Tmolus.

CAZEROM, or CAZERON, a city of Asia in Persia, situated in E. Long. 70. N. Lat. 29. 15.

CAZIC, or Cazique, a title given by the Spaniards to the petty kings, princes, and chiefs, of the several countries of America, excepting those of Peru, which are called *curatas*. The French call them *casiques*, a denomination which they always give to the Tartarian hords.—The cazics, in some places, do the office of physicians, and in others of priests, as well as of captains. The dignity of cazic among the Chiites, a people of South America, does not descend to children, but must be acquired by valour and merit. One of the prerogatives annexed to it is, that the cazic may have three wives, while the other people are allowed only one. Mexico comprehended a great number of provinces and islands, which were governed by lords called *caziques*, dependent on and tributary to the emperor. Thirty of these vassals are said to have been so powerful, that they were able, each of them, to bring an army of 100,000 men into the field.

CAZIMIR, a handsome town of Poland, in the palatinate of Lublin, situated on a hill covered with trees, in E. Long. 3. 10. N. Lat. 51. 5.

CEA. See CEOS.

CEANOTHUS, NEW-JERSEY TEA, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 43d order, *Dumosæ*. There are five petals pouched and arched. The fruit is a dry, trilocular and trispermous berry. There are three species, of which the most remarkable is the Americanus, a native of most parts of North America, from whence great plenty of the seeds have been exported into Europe. In England, this plant seldom rises more than three feet high. The stem, which is of a pale-brown colour, sends out branches from the bottom. These are thin, flexible, and of a reddish colour, which may have occasioned this tree to go by the name of *Red Twig*. The leaves which ornament these branches stand on reddish pedicles, about half an inch in length. They are oval, serrated, pointed, about two inches and a half long, are proportionably broad, and have three nerves running lengthwise. From the foot-stalk to the point they are of a light green colour, grow irregularly on the branches, and not opposite by pairs, as has been asserted. They are late in the spring before they shoot. The flowers grow at the ends of the twigs in clusters: They are of a white colour, and when in blow give the shrub a most beautiful appearance. Indeed it seems to be almost covered with them, as there is usually a cluster at the end of nearly every twig; and the leaves which appear among them serve as ornaments only, like myrtle in a distant nosegay; nature however has denied them smell. This tree will be in blow in July; and the flowers are succeeded by small brownish fruit, in which the seeds will sometimes ripen in England.



This plant is propagated by layering; or from seeds sown in pots of compost, consisting of two parts virgin earth well tempered and one part sand, about a quarter of an inch deep; being equally careful to defend the young seedlings from an extremity of cold in winter, as from the parching drought of the summer months. The best time of layering them is in the summer, just before they begin to flower: At that time lay the tender twigs of the spring shoots in the earth, and nip off the end which would produce the flowers. By the autumn twelvemonth some of them will be rooted. At the stools, however, the plants should remain until the spring, when they should be taken off, and the best rooted and the strongest may be planted in the nursery-way, or in a dry soil and well sheltered place, where they are to remain; while the bad-rooted ones and the weakest should be planted in pots; and if these are plunged into a moderate warmth of dung, it will promote their growth, and make them good plants before autumn. In the winter they should be guarded against the frosts; and in the spring they may be planted out where they are to remain.

CEBES, of Thebes, a Socratic philosopher, author of the admired *Table of Cebes*; or "Dialogues on the birth, life, and death of Mankind." He flourished about 405 years before Christ.—The above piece is mentioned by some of the ancient writers, by Lucian, D. Laertius, Tertullian, and Suidas: but of Cebes himself we have no account, save that he is once mentioned by Plato, and once by Xenophon. The former says of him, in his "Phædo," that he was a sagacious investigator of truth, and never assented without the most convincing reasons: the latter, in his "Memorabilia," ranks him among the few intimates of Socrates, who excelled the rest in the innocency of their lives. Cebes's *Tabula* is usually printed with Epictetus's *Manuale*.

CECIL, (William) lord Burleigh, treasurer of England in the reign of queen Elizabeth, was the son of Richard Cecil, Esq; master of the robes to king Henry VIII. He was born in the house of his grandfather, David Cecil, Esq; at Bourn in Lincolnshire, in the year 1520; and received the rudiments of his education in the grammar-school at Grantham. From

Cecil.

thence he was removed to Stamford; and about the year 1535, was entered of St John's College, Cambridge. Here he began his studies with a degree of enthusiastic application very uncommon in young gentlemen of family. At the age of 16 he read a sophistry lecture, and at 19 a voluntary Greek lecture, which was the more extraordinary, as being at a time when the Greek language was by no means universally understood. In 1541 he went to London, and became a member of the society of Gray's-Inn, with an intention to study the law; but he had not been long in that situation, before an accident introduced him to king Henry, and gave a new bias to his pursuits. O'Neil, a famous Irish chief, coming to court, had brought with him two Irish chaplains, violent bigots to the Romish faith; with these Mr Cecil, visiting his father, happened to have a warm dispute in Latin, in which he displayed uncommon abilities. The king being informed of it, ordered the young man into his presence, and was so pleased with his conversation, that he commanded his father to find a place for him. He accordingly requested the reversion of the *custos brevium*, which Mr Cecil afterwards possessed. About this time he married the sister of Sir John Cheke, by whom he was recommended to the earl of Hertford, afterwards duke of Somerset and protector.

Soon after king Edward's accession, Mr Cecil came into the possession of his office of *custos brevium*, worth about L.240 a-year. His first lady dying in 1543, he married the daughter of Sir Anthony Cook, director of the king's studies. In 1547, he was appointed by the protector, master of requests; and soon after, attended his noble patron on his expedition against the Scots, and was present at the battle of Musselburgh. In this battle, which was fought on the 10th of September 1547, Mr Cecil's life was miraculously preserved by a friend, who in pushing him out of the level of a cannon, had his arm shattered to pieces. The sight and judgment of his friend must have been as extraordinary as his friendship, to perceive the precise direction of a cannon shot; unless we suppose, that the ball was almost quite spent; in which case the thing is not impossible. The story is told in his life by a domestic. In the year 1548, Mr Cecil was made secretary of state; but in the following year, the duke of Northumberland's faction prevailing, he suffered in the disgrace of the protector Somerset, and was sent prisoner to the Tower. After three months confinement he was released; and in 1551 restored to his office; and soon after knighted, and sworn of the privy council. In 1553 he was made chancellor of the Order of the Garter, with an annual fee of 100 merks.

On the death of Edward VI. Mr Cecil prudently refused to have any concern in Northumberland's attempt in favour of the unfortunate Lady Jane Grey; and when queen Mary acceded to the throne, he was graciously received at Court; but, not choosing to change his religion, was dismissed from his employments. During this reign, he was twice elected knight of the shire for the county of Lincoln; and often spoke in the house of commons with great freedom and firmness, in opposition to the ministry. Nevertheless, though a Protestant and a *patriot* (that is, a courtier out of place), he had the address to steer through a very dangerous sea without shipwreck.

Cecil.

Queen Elizabeth's accession in the year 1558 immediately dispelled the cloud which had obscured his fortunes and ministerial capacity. During the horrid reign of her sister, he had constantly corresponded with the princess Elizabeth. On the very day of her accession, he presented her with a paper containing twelve articles necessary for her immediate dispatch; and, in a few days after, was sworn of the privy-council, and made secretary of state. His first advice to the queen was, to call a parliament; and the first business he proposed after it was assembled, was the establishment of a national church. A plan of reformation was accordingly drawn up under his immediate inspection and the legal establishment of the church of England was the consequence. Sir William Cecil's next important concern, was to restore the value of the coin, which had in the preceding reigns been considerably debased. In 1561, he was appointed master of the wards; and in 1571, created baron of Burleigh, as a reward for his services, particularly in having lately stifled a formidable rebellion in the north. The following year he was honoured with the garter, and raised to the office of Lord High Treasurer of England. From this period we find him the *primum mobile* of every material transaction during the glorious reign of Queen Elizabeth. Notwithstanding the temporary influence of other favourites, Lord Burleigh was, in fact, her prime minister, and the person in whom she chiefly confided in matters of real importance. Having filled the highest and most important offices of the state for 40 years, and guided the helm of government during the most glorious period of English history, he departed this life on the 4th of August 1598, in the 78th year of his age. His body was removed to Stamford, and there deposited in the family vault, where a magnificent tomb was erected to his memory.—Notwithstanding his long enjoyments of such lucrative employments, he left only an estate of L.4000 *per annum*, L.11,000 in money, and effects worth about L.14,000. He lived, indeed, in a manner suitable to his high rank and importance. He had four places of residence, viz. his lodgings at court, his house in the Strand, his seat at Burleigh-Park near Stamford, and his seat at Theobalds. The last of these was his favourite place of retirement, where he frequently entertained the queen at a vast expence.

Lord Burleigh was doubtless a man of singular abilities and prudence; amiable in his private character, and one of the most able, upright, and indefatigable ministers ever recorded in the annals of Britain. His principal works are, 1. *La Complainte de l'ame pecheresse*, or the Complaint of a Sinful Soul, in French verse, in the king's library. 2. Materials for Patten's *Diarium Exped. Scoticæ*, London 1541, 12mo. 3. Slanders and lies maliciously, grossly, and impudently vomited out, in certain traiterous books and pamphlets, against two counsellors, Sir Francis Bacon and Sir William Cecil. 4. A speech in parliament, 1562, Strype's Mem. vol. iv. p. 107. 5. Precepts or directions for the well ordering of a man's life, 1637, Harl. Cat. vol. ii. p. 755. 6. Meditations on the death of his lady, Ballard's Mem. p. 184. 7. Meditations

Meditations on the ſtate of England during the reign of queen Elizabeth, manuſcript. 8. The execution of juſtice in England for the maintenance of public and Chriſtian peace, &c. Lond. 1581, 1583, Somer's tracts, 4th collect. vol. i. p. 5. 9. Advice to queen Elizabeth in matters of religion and ſtate, ib. p. 101. 16. 10. A great number of letters. See Peck's *Deſiderata Curioſa*. Howard's collections, &c. 11. Several pedigrees, ſome of which are preſerved in the archbiſhop of Canterbury's library at Lambeth, n° 299, 747.

CECILIA, (St) the patroneſs of muſic, has been honoured as a martyr ever ſince the fifth century. Her ſtory as delivered by the notaries of the Roman church, and from them tranſcribed into the Golden Legend and other books of the like kind, ſays, that ſhe was a Roman lady born of noble parents, about the year 225. That, notwithſtanding ſhe had been converted to Chriſtianity, her parents married her to a young pagan nobleman named Valerianus; who going to bed to her on the wedding night, *as the cuſtom is*, ſays the book, was given to underſtand by his ſpouſe, that ſhe was nightly viſited by an angel, and that he muſt forbear to approach her, otherwiſe the angel would deſtroy him. Valerianus, ſomewhat troubled at theſe words, deſired that he might ſee his rival the angel; but his ſpouſe told him that was impoſſible, unleſs he would conſent to be baptiſed and become a Chriſtian. This he conſented to; after which, returning to his wife, he found her in her cloſet at prayer, and by her ſide, in the ſhape of a beautiful young man, the angel clothed with brightneſs. After ſome converſation with the angel, Valerianus told him that he had a brother named Tiburtius, whom he greatly wiſhed to ſee a partaker of the grace which he himſelf had received. The angel told him that his deſire was granted, and that they ſhould be both crowned with martyrdom in a ſhort time. Upon this the angel vaniſhed, and was not long in ſhowing himſelf as good as his word; Tiburtius was converted, and both he and his brother Valerianus were beheaded. Cecilia was offered her life upon condition that ſhe would ſacrifice to the deities of the Romans; but ſhe refuſed: upon which ſhe was thrown into a caldron of boiling water, and ſcalded to death: others ſay, that ſhe was ſtifled in a dry bath, i. e. an incloſure, from whence the air was excluded, having a ſlow fire underneath it; which kind of death was ſometimes inflicted by the Romans upon women of quality who were criminals. Upon the ſpot where her houſe ſtood, is a church ſaid to have been built by pope Urban I. who adminiſtered baptiſm to her huſband and his brother: it is the church of St Cecilia at Traſtevere; within is a moſt curious painting of the ſaint, as alſo a ſtately monument with a cumbent ſtatue of her with her face downwards. There is a tradition of St Cecilia, that ſhe excelled in muſic; and that the angel who was thus enamoured of her, was drawn from the celeſtial regions by the charms of her melody: this has been deemed authority ſufficient for making her the patroneſs of muſic and muſicians. The legend of St Cecilia has given frequent occaſion to painters and ſculptors to exerciſe their genius in repreſentations of her, playing on the organ, and ſometimes on the harp. Raphael has painted her ſinging with a regal in her hands; and Domenichino and Mignard, ſinging and playing on the harp.



CECROPS, the founder and firſt king of Athens, about the time of Moſes the lawgiver of the Hebrews. He was the firſt who eſtabliſhed civil government, religious rites, and marriage among the Greeks; and died after a reign of 50 years. See ATTICA, n° 4.

CEDAR, in botany. See JUNIPERUS and PINUS.

The ſpecies of cedar famous for its duration, is that popularly called by us the cedar of Lebanon (Pinus cedrus), by the ancients *cedrus magna*, or the great cedar; alſo *cedrelate*, Κεδρελατη. See the article PINUS.

CEDRENUS, (George) a Grecian monk, lived in the 11th age, and wrote "Annals, or an abridged Hiſtory, from the Beginning of the World to the Reign of Iſaac Comnenus emperor of Conſtantinople, who ſucceeded Michael IV. in 1057." This work is no more than an extract from ſeveral hiſtorians. There is an edition of it, printed at Paris in 1647, with the Latin verſion of Xylander, and the notes of father Goar a Dominican.

CEDRUS, the CEDAR-TREE, MAHOGANY, &c. See JUNIPERUS, PINUS, and SWIETENIA.

CEILING, in architecture, the top or roof of a lower room; or a covering of plaſter, over laths nailed on the bottom of the joiſts that bear the floor of the upper room; or where there is no upper room, on joiſts for the purpoſe; hence called *cieling joiſts*. The word *ceiling* anſwers prettily to the Latin *lacunar*, "every thing over head."

Plaſtered ceilings, are much uſed in Britain, more than in any other country: nor are they without their advantages, as they make the room lightſome; are good in caſe of fire; ſtop the paſſage of the duſt; leſſen the noiſe over head; and, in ſummer, make the air cooler.

CEILING, in ſea-language, denotes the inſide planks of a ſhip.

CEIMELIA, from κειμαι, "to be laid up," in antiquity, denotes choice or precious pieces of furniture or ornaments, reſerved or laid up for extraordinary occaſions and uſes; in which ſenſe, ſacred garments, veſſels, and the like, are reputed of the ceimelia of a church. Medals, antique ſtones, figures, manuſcripts, records, &c. are the ceimelia of men of letters.

CEIMELIARCHIUM, the repoſitory or place where ceimelia are preſerved.

CEIMELIOPHYLAX, (from κειμηλιον and φυλαττω, I *keep*), the keeper or curator of a collection of ceimelia; ſometimes alſo denominated *ceimeliarcha*. The ceimeliarcha, or ceimeliophylax, was an officer in the ancient churches or monaſteries, anſwering to what was otherwiſe denominated *chartophylax*, and *cuſtos archivorum*.

CELÆNÆ, (anc. geog.) the capital of Phrygia Magna, ſituated on a cognominal mountain, at the common ſources of the Mæander and Marſyas. The king of Perſia had a ſtrong palace beneath the citadel, by the ſprings of the Marſyas, which roſe in the market-place, not leſs in ſize than the Mæander, and flowed through the city. Cyrus the younger had alſo a palace there, but by the ſprings of the Mæander, which river paſſed likewiſe through the city. He had, moreover, an extensive paradise or park, full of wild beasts, which he hunted on horseback for exercise or amusement; and watered by the Mæander, which ran through the middle. Xerxes was said to have built these palaces and the citadel after his return from his expedition into Greece.

Antiochus Soter removed the inhabitants of Celænæ into a city, which he named from his mother, Apamea; and which became afterwards a mart inferior only to Ephesus. See APAMEA.

CALANDINE, in botany. See CHELIDONIUM.

CELANO, a town of Italy, in the kingdom of Naples, in Farther Abruzzo. It is seated a mile from the lake Celano, anciently called FUCINUS. E. Long. 13. 39. N. Lat. 41. 56.

CELARENT, among logicians, a mode of syllogism, wherein the major and conclusion are universal negative propositions, and the minor an universal affirmative.

*E. gr. cE* None whose understanding is limited can be omniscient.

*lA* Every man's understanding is limited.

*rEnt* Therefore no man is omniscient.

CELASTRUS, in botany: A genus of the monogynia order, belonging the pentandria class of plants; and in the natural method ranking under the 43d order, *Dumosæ*. The corolla is pentapetalous and patent; the capsule quinquangular and trilocular; the seeds veiled. There are 11 species; two of which are enured to Britain.

1. The bullatus, an uncertain deciduous shrub, is a native of Virginia. It is about four feet in growth, rising from the ground with several stalks, which divide into many branches, and are covered with a brownish bark. The leaves are of a fine green colour, and grow alternately on the branches. They are of an oval figure, and have their edges undivided. The flowers are produced in July, at the ends of the branches, in loose spikes. They are of a white colour, and in their native countries are succeeded by very ornamental scarlet fruit; but in Britain this seldom happens. It is easily propagated from seeds sown, about an inch deep, in beds of good fresh mould made fine. They seldom come up until the second, and sometimes not before the third spring. It is also propagated by layers; which work must be performed on the young wood, in the autumn, by a slit at the joint. These layers may be expected to strike root by the autumn following; when they may be taken up and planted in the nursery-ground. This shrub must have a well-sheltered situation, otherwise the leaves are apt to fall off at the approach of frosty weather. And Millar says, that, growing naturally in moist places, it will not thrive well in a dry soil.

2. The scandens, or bastard euonymus, with woody twining stalks, rising by the help of neighbouring trees or bushes to the height of 12 feet. The leaves are oblong, serrated, of a pleasant green colour, pale, and veined underneath, and grow alternately on the branches. The flowers are produced in small bunches, from the sides of the branches, near the ends. They are of a greenish colour, appear in June; and are succeeded by roundish, red, three-cornered capsules, containing ripe seeds, in the autumn. This species is exceeding hardy, and makes a beautiful appearance among other trees in the autumn, by their beautiful red berries, which much resemble those of the Spindle-tree, and will be produced in vast profusion on the tops of other trees, to the height of which these plants by their twisting property aspire. They should not be planted near weak or tender trees, to climb on; for they embrace the stalks so closely as to bring on death to any but the hardiest trees and shrubs. It is propagated, 1. By laying down the young shoots in the spring. By the autumn they will have struck root, and may then be taken off and set in the places where they are designed to remain. 2. By seeds; which should be soon sown after they are ripe, otherwise they will be two and sometimes three years before they come up. When they make their appearance, nothing more need be done than keeping them clear from weeds all summer and the winter following; and in the spring the strongest plants may be drawn out, and set in the nursery for a year, and then removed to the places where they are designed to remain; whilst the weakest, being left in the seed-bed one year more, may undergo the same discipline.



In Senegal the negroes use the powder of the root as a specific against gonorrhœas, which it is said to cure in eight or sometimes in three days. An infusion of the bark of a species of staff-tree, which grows in the Isle of France, is said to possess the same virtues.

CELEBES, an island in the Indian sea, seated under the equator, and called by some *Macassar*. The length and breadth has not been accurately computed; but the circumference, at a medium, is about 800 miles. It had formerly six kingdoms, which are reduced to one. The air is hot and moist; and subject to great rains during the north-west winds, which blow from November to March, at which time the country is overflowed, and for this reason they build their houses on piles of wood 10 feet high. The most healthful time is during the northern monsoons, which seldom fail blowing regularly in one part of the year. The chief vegetables are rice and cocoas; but they have ebony, sanders, &c. Their fruits and flowers are much the same as in the neighbouring parts of the Indies. They have pepper, sugar, betel, areca, the finest cotton, and opium. The natives have bright olive complexions, and the women have shining black hair. They are thought to be very handsome by the Dutch and Chinese, who often purchase them for bedfellows. The men are industrious, robust, and make excellent soldiers. Their arms are sabres, and trunks, from whence they blow poisoned darts, which are pointed with the tooth of a sea-fish. Some likewise use poisoned daggers. They were the last of the Indian nations that were enslaved by the Dutch, which could not be effected till after a long war. They teach their children to read and write, and their characters have some resemblance of the Arabic. Their religion being Mahometan, the men indulge themselves in many wives and concubines. The employment of the women is spinning, cookery, and making their own and their husbands cloaths. The men wear jewels in their ears, and the women gold chains about their necks. The inhabitants in general go half naked, without any thing on their head, legs, or feet, and some have nothing but a cloth about their middle. The streets of the

Celeres, Celeri. the town Macassar are spacious, and planted with trees on every side. It stands by the side of the only large river they have in the island. The Dutch have a fort here, mounted with 40 guns, and garrisoned with 700 men. There is only one other town of note, called Jampandam, where they also have a fort. The island is not near so populous as when the Dutch conquered it; the men being hired for soldiers in most of the neighbouring countries.

The religion of these islands was formerly idolatry. They worshipped the sun and moon. They sacrificed to them in the public squares, having no materials which they thought valuable enough to be employed in raising temples. About two centuries ago, some Christians and Mahometans having brought their opinions to Celebes, the principal king of the country took a dislike to the national worship. Having convened a general assembly, he ascended an eminence, when, spreading out his hands towards heaven, he told the Deity, that he would acknowledge for truth that doctrine whose ministers should first arrive in his dominions, and as the winds and waves were at his command, the Almightly would have himself to blame if he embraced a falsehood. The assembly broke up, determined to wait the orders of heaven, and to obey the first missionaries that should arrive. The mahometans were the most active, and their religion accordingly prevailed.

CELERES, in Roman antiquity, a regiment of body-guards belonging to the Roman kings, established by Romulus, and composed of 300 young men, chosen out of the most illustrious Roman families, and approved by the suffrages of the curiæ of the people, each of which furnished ten. The name comes from *celer*; "quick, ready;" and was given them because of their promptness to obey the king.

The celeres always attended near the king's person, to guard him, to be ready to carry his orders, and to execute them. In war, they made the van-guard in the engagement, which they always began first; in retreats, they made the rear-guard.

Though the celeres were a body of horse, yet they usually dismounted, and fought on foot; their commander was called tribune, or prefect of the celeres. They were divided into three troops, of 100 each, commanded by a captain called centurio: their tribune was the second person in the kingdom.

Plutarch says, Numa broke the celeres; if this be true, they were soon re-established; for we find them under most of the succeeding kings: witness the great Brutus, who expelled the Tarquins, and who was the tribune of the celeres.

CELERI, in botany, the English name of a variety of the Apium Graveolens.

The seed of celeri should be sown at two or three different times, the better to continue it for use thro' the whole season without running up to feed. The first sowing should be in the beginning of March, upon a gentle hot-bed; the second may be at the end of the same month, which ought to be in an open spot of light earth, where it may enjoy the benefit of the sun; the third time of sowing should be in the latter end of April, or beginning of May, on a moist soil; and if exposed to the morning-sun only, it will be so much the better, but it should not be under the drip of trees. The middle of May, some of the plants of the first sowing will be fit to transplant for blanching. Celeri.

The manner of transplanting it is as follows: after having cleared the ground of weeds, you must dig a trench by a line about 10 inches wide, and 8 or 9 inches deep, loosening the earth in the bottom, and laying it level: and the earth that comes out of the trench should be equally laid on each side the trench, to be ready to draw in again to earth the celeri as it advances in height. These trenches should be made at three feet distance from each other: then plant your plants in the middle of the trench, at about four or five inches distance, in one straight row, having before trimmed the plants, and cut off the tops of the long leaves: and as they are planted, you must observe to close the earth well to their roots with your feet, and to water them plentifully until they have taken new root. As these plants advance in height, you must observe to draw the earth on each side close to them, being careful not to bury their hearts, nor ever to do it but in dry weather; otherwise the plants will rot. When your plants have advanced a considerable height above the trenches, and all the earth, which was laid on the sides thereof, hath been employed in earthing them up, you must then make use of a spade to dig up the earth between the trenches, which must also be made use of for the same purpose continuing from time to time to earth it up until it is fit for use. The last crop should be planted in a drier soil, to prevent its being rotted with too much wet in the winter. You will do well to cover your ridges of celeri with some pease-haulm, or some such light covering, when the frost is very hard, which will admit the air to the plants; for if they are covered too close, they will be very subject to rot: by this means you will preserve your celeri till spring; but you must remember to take off the covering whenever the weather will permit, otherwise it will be apt to cause the celeri to pipe, and run to seed. The celeri, when full blanched, will not continue good above three weeks or a month before it will rot or pipe; therefore, in order to continue it good, you should have, at least, six or seven different seasons of planting, proportioned to the consumption.

The other sort of celeri, which is commonly called celeriac, is to be managed in the same manner; excepting that this should be planted on the level ground, or in very shallow drills: for this plant seldom grows above eight or ten inches high, so requires but little earthing up; the great excellency of this being in the size of the root, which is often as large as ordinary turnips.

The best method to save the seed of celeri, is to make choice of some long good roots of the upright celeri, which have not been too much blanched, and plant them out, at about a foot asunder, in a moist soil, early in the spring; and when they run up to seed, keep them supported with stakes, to prevent their being broken down with the wind: and in July, when the seed begins to be formed, if the season should prove very dry, it will be proper to give some water to the plant, which will greatly help its producing good seeds. In August these seeds will be ripe, at which time it should be cut up, in a dry time, and spread upon cloths in the sun to dry; then beat out the seeds, and preserve it in bags for use.

*Celeri, wild, (Apium antarcticum),* was found in considerable quantities by Mr Banks and Dr Solander, on the coast of Terra del Fuego. It is like the garden celeri in the colour and disposition of the flowers, but the leaves are of a deep green. The taste is between that of celeri and parsley. It is a very useful ingredient in the soup for seamen, because of its antiscorbutic quality.

CELERITY, in mechanics, the swiftness of any body in motion. It is also defined to be an affection of motion, by which any moveable body runs through a given space in a given time.

CELESTINS, a religious order so called from their founder Peter de Meuron, afterwards raised to the pontificate under the name of Celestin V. This Peter, who was born at Isernia, a little town in the kingdom of Naples, in the year 1215, of but mean parents, retired, while very young, to a solitary mountain, in order to dedicate himself wholly to prayer and mortification. The fame of his piety brought several, out of curiosity, to see him; some of whom, charmed with his virtues, renounced the world to accompany him in his solitude. With these he formed a kind of community in the year 1254; which was approved by Pope Urban IV. in 1264, and erected into a distinct order, called the *hermits of St Damien.* Peter de Meuron governed this order till 1286, when his love of solitude and retirement induced him to quit the charge. In July 1294, the great reputation of his sanctity raised him, though much against his will, to the pontificate. He then took the name of Celestin V. and his order that of *Celestins* from him. By his bull he approved their constitutions, and confirmed all their monasteries to the number of 20. But he sat too short time in the chair of St Peter to do many great things for his order; for having governed the church five months and a few days, and considering the great burden he had taken upon him, to which he thought himself unequal, he solemnly renounced the pontificate in a consistory held at Naples.

After his death, which happened in 1296, his order made great progress not only in Italy, but in France likewise; whither the then general Peter of Tivoli sent 12 religious, at the request of king Philip the Fair, who gave them two monasteries; one in the forest of Orleans, and the other in the forest of Compeigne at mount Chartres. This order likewise passed into several provinces of Germany. They have about 96 convents in Italy, and 21 in France, under the title of priories.

The Celestins rise two hours after midnight, to say matins. They eat no flesh at any time, except when they are sick. They fast every Wednesday and Friday, from Easter to the feast of the exaltation of the holy cross; and, from that feast to Easter, every day. As to their habit, it consists of a white gown, a capuche, and a black scapulary. In the choir, and when they go out of the monastry, they wear a black cowl with the capuche: their shirts are of serge.

CELETES, or Celetæ, (from κελης, *a race-horse,)* in antiquity, denote single or saddle-horses; by way of contradistinction from those yoked or harnessed together, called *bigarii, quadrigarii,* &c. The same denomination is also given to the cavaliers or riders on horseback; and hence some duduce celeres, the name of Romulus's guard.

CELEUSMA, or Celeuma, in antiquity, the shout or cry of the seamen, whereby they animated each other in their work of rowing. The word is formed from κελευειν, *to call, to give the signal.*

Celeusma was also a kind of song or formula, rehearsed or played by the master, or others, to direct the strokes and movements of the mariners, as well as to encourage them to labour. See Celeustes.

CELEUSTES, in ancient navigation, the boatswain or officer appointed to give the rowers the signal when they were to pull, and when to stop. He was also denominated *epopeus,* and by the Romans *portisculus,* sometimes simply *hortator.*

CELIBACY, the state of unmarried persons. Scaliger derives the word from the Greek κοιτη, "bed," and λειπω *linquo,* "I leave" others say it is formed from *cali beatitudo;* q. d. *the blessedness of heaven.*

The ancient Romans used all means imaginable to discourage celibacy. Nothing was more usual than for the censors to impose a fine on bachelors. Dionysius Halicarnassensis mentions an ancient constitution whereby all persons of full age were obliged to marry. But the first law of that kind, of which we have any certainty, is that under Augustus, called *lex Julia de maritandis ordinibus.* It was afterwards denominated *Papia Poppæa,* and more usually *Julia Papia,* in regard of some new sanction, and amendments made to it under the consuls Papius and Poppæus. By this law divers prerogatives were given to persons who had many children; penalties imposed on those who lived a single life, as that they should be incapable of receiving legacies, and not exceeding a certain proportion.

CELIBATE, the same with celibacy; but it is chiefly used in speaking of the single life of the Popish clergy, or the obligation they are under to abstain from marriage. In this sense we say the law of *celibate.* Monks and religious take a vow of celibate; and what is more, of chastity.

The church of Rome imposes an universal celibacy on all its clergy, from the pope to the lowest deacon and subdeacon. The advocates for this usage pretend, that a vow of perpetual celibacy was required in the ancient church as a condition of ordination, even from the earliest apostolic ages. But the contrary is evident from numerous examples of bishops and archbishops, who lived in a state of matrimony, without any prejudice to their ordination or their function. It is generally agreed that most of the apostles were married. Some say all of them, except St Paul and St John. Others say St Paul himself was married, because be writes to his *yoke-fellow,* whom they interpret his wife. Be this as it will, in the next ages after the apostles, we have accounts of divers married bishops, presbyters, and deacons, without any reproof or mark of dishonour set on them; *e. g.* Valens, presbyter of Philippi, mentioned by Polycarp; and Chæremon, bishop of Nilus. Novatus was a married presbyter of Carthage, as we learn from Cyprian; who himself was also a married man, as Pagi confesses; and so was Cæcilius the presbyter who converted him; and Numidius another presbyter of Carthage. The reply which the Romaniſts give to this is, that all married perſons, when they came to be ordained, promiſed to live ſeparate from their wives by conſent, which anſwered the vow of celibacy in other perſons. But this is not only ſaid without proof, but againſt it. For Novatus preſbyter of Carthage, was certainly allowed to cohabit with his wife after ordination; as appears from the charge that Cyprian brings againſt him, that he had ſtruck and abuſed his wife, and thereby cauſed her to miſcarry. There ſeems indeed to have been, in ſome caſes, a tendency towards the introduction of ſuch a law, by one or two zealots; but the motion was no ſooner made, than it was quaſhed by the authority of wiſer men. Thus Euſebius obſerves, that Pinytus, biſhop of Gnoſſus in Crete, was for laying the law of celibacy upon his brethren; but Dionyſius biſhop of Corinth wrote to him, that he ſhould conſider the weakneſs of men, and not impoſe that heavy burden on them. In the council of Nice, *anno* 325, the motion was renewed for a law to oblige the clergy to abſtain from all conjugal ſociety with their wives, whom they had married before their ordination: but Paphnutius, a famous Egyptian biſhop, and one who himſelf never was married, vigorouſly declaimed againſt it, upon which it was unanimouſly rejected. So Socrates and Sozomen tell the ſtory; to which all that Valeſius, after Bellarmin, has to ſay, is, that he ſuſpects the truth of it. The council in Trullo, held in 692, made a difference in this reſpect between biſhops and preſbyters; allowing preſbyters, deacons, and all the inferior orders, to cohabit with their wives after ordination; and giving the Roman church a ſmart rebuke for the contrary prohibition, but at the ſame time laying an injunction upon biſhops to live ſeparate from their wives, and appointing the wives to betake themſelves to a monaſtic life, or become deaconeſſes in the church. And thus was a total celibate eſtabliſhed in the Greek church, as to biſhops, but not any others. In the Latin church, the like eſtabliſhment was alſo made, but by ſlow ſteps in many places. For in Africa, even biſhops themſelves cohabited with their wives at the time of the council of Trullo. The celibacy of the clergy, however, appears of an ancient ſtanding, if not of command and neceſſity, yet as of counſel and choice. But as it is clearly neither of divine nor apoſtolical inſtitution, it is, at firſt, hard to conceive from what motive the court of Rome perſiſted ſo very obſtinately to impoſe this inſtitution on the clergy. But we are to obſerve that this was a leading ſtep to the execution of the project formed of making the clergy independent of princes, and rendering them a ſeparate body to be governed by their own laws. In effect, while prieſts had children, it was very difficult to prevent their dependence on princes, whoſe favours have ſuch an influence on private men; but having no family, they were more at liberty to adhere to the Pope.

CELIDOGRAPHIA, the deſcription of the ſpots which appear on the ſurfaces of the ſun and planets. See Astronomy, n° 58, &c.

CELL, cella, in ancient writers, denotes a place or apartment uſually under ground, and vaulted, in which were ſtored up ſome ſort of neceſſaries, as wine, honey, and the like; and according to which it was called *Cella Vinaria, Olearia, Meliaria*, &c. The word is formed from the Latin *celare*, to conceal.

Cella was alſo uſed for the lodge or habitation of a common proſtitute, as being anciently under ground, hence alſo denominated *fornix*.

> *Intravit calidum veteri centone lupanar,*
> *Et cellam vacuam.* Juv. Sat. vi. ver. 121.

On which place an ancient ſcholiaſt remarks, that the names of the whores were written on the doors of their ſeveral cells; by which we learn the meaning of *inſcripta cella* in Martial, lib. xi. ep. 46.

Cella was alſo applied to the bed-chambers of domeſtics and ſervants; probably as being low and narrow.—Cicero, inveighing againſt the luxury of Antony, ſays, the beds in the very cellæ of his ſervants were ſpread with pompous purple coverlets.

Cella is alſo applied to the members or apartments of baths. Of theſe there were three principal, called *frigidaria, tepidaria*, and *caldaria*; to which may be added a fourth, called *cella aſſa*, and ſometimes *ſudatoria*.

Cella likewiſe ſignified the *adyta*, or inmoſt and moſt retired parts of temples, wherein the images of the gods to whom the edifices were conſecrated were preſerved. In this ſenſe we meet with *cella Jovis, cella Concordiæ*, &c.

Cell is alſo uſed for a leſſer or ſubordinate ſort of miniſter dependent on a great one, by which it was erected, and continues ſtill to be governed. The great abbeys in England had moſt of them *cells* in places diſtant from the mother abbey, to which they were accountable, and from which they received their ſuperiors. The alien priories in England were cells to abbeys in Normandy, France, Italy, *&c.* The name *cell* was alſo given to rich and conſiderable monaſteries not dependent on any other.

Cell ſignifies alſo a little apartment or chamber, ſuch as thoſe wherein the ancient monks, ſolitaries, and hermits, lived in retirement. Some derive the word from the Hebrew כלא, *i. e.* "a priſon, or place where any thing is ſhut up."

The ſame name is ſtill retained in divers monaſteries. The dormitory is frequently divided into ſo many cells or lodges. The Carthuſians have each a ſeparate houſe, which ſerves them as a cell. The hall wherein the Roman conclave is held, is divided, by partitions, into divers cells, for the ſeveral cardinals to lodge in.

Cell is alſo a name given to the little diviſions in honey-combs, which are always regular hexagons. See Bee.

Cell, in botany, is applied to the hollow places between the partitions in the pods, huſks, and other ſeed-veſſels of plants; according as there is one, two, three, *&c.* of theſe cells, the veſſel is ſaid to be unilocular, bilocular, trilocular, *&c.*

Cells, in anatomy, little bags, or bladders, where fluids or other matters are lodged; called *loculi, cellulæ*, &c. Thus the *cellulæ adipoſæ* are the little cells where the fat is contained; *cellulæ* in the *colon*, are ſpaces wherein the excrements are detained till voided, &c.

CELLAR, *(Cellarium)* in ancient writers, denotes the ſame with cella, viz. a conſervatory of eatables, or drinkables.

Cellar differs from vault, as the latter is supposed to be deeper, the former being frequently little below the surface of the ground. In which sense, *cellarium* only differed from *penus*, as the former was only a store-house for several days, the latter for a long time. Thus it is, the bactroperatæ, a sort of ancient Cynics, are said by St Jerome to carry cellar about with them.

*Cellarium* also denoted an allowance of bread, wine, oil, or other provision, furnished out of the cella, to the use of the governor of the province and his officers, &c. In which sense, the word amounts to much the same with *annona*.

CELLARS, in modern building, are the lowest rooms in a house, the ceilings of which usually lie level with the surface of the ground on which the house is built; or they are situated under the pavement before the house, especially in streets and squares.

Cellars, and other places vaulted under ground, were called by the Greeks *hypogæa*: the Italians still call them *fundi delle case*.

CELLARER, or CELLERER, (*Cellerarius* or *Cellarius*), an officer in monasteries, to whom belong the care and procurement of provisions for the convent. The denomination is said to be borrowed from the Roman law, where *cellarius* denotes an examiner of accounts and expences. Ulpian defines it thus: 'Cellerarius, id est, ideo præpositus ut rationes salvæ sint."

The *cellerarius* was one of the four *obedientiarii*, or great officers of monasteries: under his ordering was the *pistrinum* or bakehouse, and the *bracinum*, or brewhouse. In the richer houses there were particular lands set apart for the maintenance of his office, called in ancient writings *ad cibum monachorum*. The *cellerarius* was a great man in the convent. His whole office in ancient times had a respect to that origin: he was to see his lord's corn got in, and laid up in granaries; and his appointment consisted in a certain proportion thereof, usually fixed at a thirteenth part of the whole, together with a furred gown. The office of cellarer then only differed in name from those of bailiff and minstrel; excepting that the cellarer had the receipt of his lord's rents through the whole extent of his jurisdiction.

CELLARER was also an officer in chapters, to whom belonged the care of the temporals, and particularly the distributing of bread, wine, and money to canons, on account of their attendance in the choir. In some places he was called *cellarer*, in others *burser*, and in others *currier*.

CELLARIUS, (Christopher) was born in 1638, at Smalcade in Franconia, of which town his father was minister. He was successively rector of the colleges at Weymar, Zeits, and Mersbourg; and the king of Prussia having founded an university at Hall in 1693, he was prevailed on to be professor of eloquence and history there, where he composed the greatest part of his works. His great application to study hastened the infirmities of old age; for it is said, he would spend whole days and nights together at his books, without any attention to his health, or even the calls of nature. His works relate to grammar, geography, history, and the oriental languages, and the number of them is amazing. He died in 1707.

CELLINI, (Benvenuto) an eminent statuary, who was bred a jeweller and goldsmith, but seems to have had an extraordinary genius for the fine arts in general. He was cotemporary with Michael Angelo, and Julio Romano, and was employed by popes, kings, and other princely patrons of sciences and arts, so highly cultivated in the days of Leo X. and Charles V. some of his productions being esteemed most exquisite. He lived to a very considerable old age; and his life, almost to the last, was a continued scene of adventure, persecution, and misfortune, truly wonderful. He wrote his own history, which was not, however, published till the year 1730, probably on account of the excessive freedom with which he therein treated many distinguished personages of Italy and other countries. It was translated into English by Dr Nugent in 1771, to which the reader is referred, as it will not admit of an abridgement suitable to the design of this work.

CELLULAR, in a general sense, is applied to any thing consisting of single cells.

CELLULAR *Membrane*. See ANATOMY, n° 83, *et seq*.

CELOSIA, COCKS-COMB: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 54th order, *Miscellaneæ*. The calyx is triphyllous; the corolla is five-petalled in appearance; the stamina are conjoined at the base to the plaited nectarium; the capsule gaping horizontally. There are eight species, of which the most worthy of notice is the *cristata*, or common cocks-comb, so called on account of its crested head of flowers, resembling a cock's comb; of these there are a great variety of species. The principal colours of their flowers are red, purple, yellow, and white; but there are some whose heads are variegated with two or three colours. The heads are sometimes divided like a plume of feathers, and are of a beautiful scarlet colour. These plants are very tender exotics, and require a great deal of care to cultivate them in England. Three hot-beds must be prepared; a small one in March, on which to raise the plants an inch or two in height; a second in April, of larger dimensions, in which to transplant them when proper; and a third in May for a large frame, to receive them transplanted into pots, to remain till the end of June or beginning of July to grow to full size: all of which hot-beds must be covered with frames and glasses, and have five or six inches depth of fine rich light earth for the reception of the seed and plants; and in the second and third hot-bed, the frames must occasionally be raised or augmented, according as the plants shall rise in height.

CELSIA, in botany: A genus of the angiospermia order, belonging to the tridynamia class of plants; and in the natural method ranking under the 28th order, *Luridæ*. The calyx is quinquepartite: the corolla wheel-shaped; the filaments bearded or woolly; the capsule bilocular.

CELSUS, (Aurelius Cornelius) a celebrated physician of the first century, who wrote eight books on medicine, in elegant Latin. He was the Hippocrates of the Latins, and Quintilian gives him a high eulogium. The great Boerhaave tells us, that Celsus is one of the best authors of antiquity for letting us into the true meaning and opinions of Hippocrates; and that, without him, the writings of this father in physic

ſic would be often unintelligible, often miſunderſtood by us. He ſhows us alſo, how the ancients cured diſtempers by friction, bathing, &c. His eight books *de Midicina* have been ſeveral times printed. The Elzivir edition, in the year 1650, by Vander Linden, is the beſt, as being entirely corrected from his manuſcripts.

Celsus, an Epicurean philoſopher, in the ſecond century. He wrote a work againſt the Chriſtians, entitled, *The true Diſcourſe*; to which Origen, at the deſire of Ambroſe his friend, wrote a learned anſwer. To this philoſopher Lucian dedicated his *Pſeudomanies*.

CELTÆ, or Celtes, an ancient nation, by which moſt of the countries of Europe are thought to have been peopled. The compilers of the Univerſal Hiſtory are of opinion, that they are deſcended from Gomer the eldeſt ſon of Japhet, the ſon of Noah. They think that Gomer ſettled in the province of Phrygia in Aſia: Aſhkenaz his eldeſt ſon, or Togarmah his youngeſt, or both, in Armenia, and Riphath the ſecond ſon in Cappadocia. When they ſpread themſelves wider, they ſeem to have moved regularly in columns without interfering with or diſturbing their neighbours. The deſcendants of Gomer, or the Celtæ, took the left hand, inſenſibly ſpreading themſelves weſtward towards Poland, Hungary, Germany, France, and Spain; while the deſcendants of Magog, Gomer's brother, moving eaſtward, peopled Tartary.

In this large European tract, the Celtes began to appear a powerful nation under a regular monarchy, or rather under ſeveral conſiderable kingdoms. Mention is made of them indeed in ſo many parts of Europe, by ancient geographers and hiſtorians, that Ortelius took *Celtica* to be a general name for the continent of Europe, and made a map of it bearing this title. In thoſe parts of Aſia, which they poſſeſſed, as well as in the different parts of Europe, the Celtes went by various names. In Leſſer Aſia they were known by the names of *Titans*, and *Sacks*; in the northern parts of Europe, by thoſe of *Cymmerians*, *Cymbrians*, &c.; and in the ſouthern parts they were called *Celtes*, *Gauls*, or *Galatians*.

With reſpect to the government of the Celtes we are entirely in the dark. All we know is, that the curetes, and afterwards druids and bards, were the interpreters of their laws; judged all cauſes whether criminal or civil; and their ſentence was reckoned ſo ſacred, that whoever refuſed to abide by it was by them excluded from aſſiſting at their ſacred rites; after which no man dared converſe with him; ſo that this puniſhment was reckoned the moſt ſevere of all, even ſeverer than death itſelf.

They neither reared temples nor ſtatues to the deity, but deſtroyed them wherever they could find them, planting in their ſtead large ſpacious groves; which being open on the top and ſides, were, in their opinion, more acceptable to the divine Being, who is abſolutely unconfined. In this their religion ſeems to have reſembled that of the Perſees and diſciples of Zoroaſter. The Celtes only differed from them in making the oak inſtead of the fire the emblem of the deity; in chooſing that tree above all others to plant their groves with, and attributing ſeveral ſupernatural virtues both to its wood, leaves, fruit, and miſsletoe; all which were made uſe of in their ſacrifices and other parts of their worſhip. But after they had adopted the idolatrous ſuperſtition of the Romans and other nations, and the apotheoſis of their heroes and princes, they came to worſhip them much in the ſame manner: as Jupiter under the name of *Taran*, which in the Celtic ſignifies thunder: Mercury, whom ſome authors call *Heus* or *Heſus*, probably from the Celtic *huadh*, which ſignifies a dog, and might be the *Anubis latrans* of the Egyptians. But Mars was held in the greateſt veneration by the warlike, and Mercury by the trading part of the nation. The care of religion was immediately under their curetes, ſince known by the name of druids and bards. Theſe were, as Cæſar tells us, the performers of ſacrifices and all religious rites, and expounders of religion to the people. They alſo inſtructed youth in all kinds of learning, ſuch as philoſophy, aſtronomy, aſtrology, &c. Their doctrines were taught only by word of mouth, eſteeming them too ſacred to be committed to writing. Other more common ſubjects, ſuch as their hymns to their gods, the exploits of princes and generals in time of war, and eſpecially before a battle, were couched in elegant verſe, and recited, or rather ſung, on all proper occaſions; though even theſe were alſo kept from vulgar eyes, and either committed to memory, or if to writing, the whole was a ſecret to all the laity. The latter indeed ſeems the moſt probable, if what Cæſar hints be true; namely, that theſe poetic records were increaſed in his time to ſuch a bulk, that it took up a young bard near 20 years to learn them by heart. Diodorus tells us farther, that theſe poets uſed to accompany their ſongs with inſtrumental muſic, ſuch as that of organs, harps, and the like; and that they were held in ſuch veneration, that if, in the time of an engagement between two armies, one of theſe bards appeared, both ſides immediately ceaſed fighting. The reaſon of this was, that they were univerſally believed to be prophets as well as poets; ſo that it was thought dangerous as well as injurious to diſobey what they ſuppoſed came from their gods. Theſe prophetic philoſophers kept academies, which were reſorted to not only by a great number of their own youth, but alſo of thoſe from other countries, inſomuch that Ariſtotle ſays their philoſophy paſſed from thence into Greece, and not from Greece thither. Diodorus likewiſe quotes a paſſage from Hecateus, which is greatly in their praiſe; *viz.* that the druids had ſome kind of inſtruments by which they could draw diſtant objects nearer, and make them appear larger and plainer; and by which they could diſcover even ſeas, mountains, and valleys, in the moon. But whatever might be their learning, it is certain, that in proceſs of time, they adopted ſeveral very barbarous cuſtoms, ſuch as ſacrificing human victims to their gods as more acceptable to them than thoſe of any other animals. And Diodorus tells us of another inhuman cuſtom they uſed in their divinations, eſpecially in great matters, which was done by killing ſome of their ſlaves, or ſome priſoners of war, if any they had, with a ſcimetar, to draw their augury from the running of his blood from his mangled limbs.

For the hiſtory, &c. of the different Celtic nations ſee the article Gaul, &c.

Celtes, certain ancient inſtruments of a wedge-like form, of which ſeveral have been diſcovered in different

different parts of Great-Britain. Antiquarians have generally attributed them to the Celtæ; but, not agreeing as to their use, distinguished them by the above unmeaning appellation. But Mr Whittaker makes it probable that they were British battle-axes. See *Battle-Ax*.

CELTIBERIA, (anc. geog.) a county of the Hither Spain, along the right or south-west side of the river Iberus; though sometimes the greatest part of Spain was called by the name of *Celtiberia*. The people were denominated *Celtiberi*, or the Celtæ seated on the Iberus. They were very brave and warlike, their cavalry in particular was excellent. They wore a black and rough cloak, the shag of which was like goat's hair. Some of them had light bucklers like the Gauls; other hollow and round ones like those of other nations. They all wore boots made of hair, and iron helmets adorned with crests of a purple colour. They used swords which cut on both sides, and poinards of a foot long. Their arms were of an admirable temper, and are said to have been prepared in the following manner: they buried plates of iron under ground, where they let them remain till the rust had eaten the weakest part of the metal, and the rest was consequently hard and firm. Of this excellent iron they made their swords, which were so strong and well tempered, that there was neither buckler nor helmet that could resist their edge. The Celtiberians were very cruel towards their enemies and malefactors, but showed the greatest humanity to their guests. They not only cheerfully granted their hospitality to strangers who travelled in their country, but were desirous that they should seek protection under their roof.

CELTIS, in botany: A genus of the monœcia order, belonging to the polygamia class of plants; and in the natural method ranking under the 53d order, *Scabridæ*. It is an hermaphrodite plant: The female calyx is quinquepartite; there is no corolla; there are five stamina, and two styles. The fruit is a monospermous plum. In the male, there is no calyx: the corolla is hexapetalous; there are six stamina, and an embryo of a pistillum. There are three species, all of them deciduous, viz.

1. The Australis or Southern Celtis, a deciduous tree, native of Africa and the South of Europe. 2. The Occidentalis or Western Celtis, a native of Virginia. And 3. The Orientalis or Eastern Celtis, a native of Armenia. The two first species grow with large, fair, straight stems; their branches are numerous and diffuse; their bark is of a darkish grey colour; their leaves are of a pleasant green; three or four inches long, deeply serrated, end in a narrow point, nearly resemble the leaves of the common stinging-nettle, and continue on the trees till late in the autumn: So that one may easily conceive what an agreeable variety these trees would make. Add to this, their shade is admirable. The leaves are late in the spring before they show themselves; but they make amends for this, by retaining their verdure till near the close of autumn, and then do not resemble most deciduous trees, whose leaves show their approaching fall by the change of their colour; but continue to exhibit themselves of a pleasant green even to the last. Hanbury speaks highly of the celtis as a timber-tree: he says, "The wood of the Lote-tree is extremely durable. In Italy they make their flutes, pipes, and other wind-instruments of it. With us the coach-makers use it for the frames of their vehicles." Millar mentions also the wood of the Occidentalis being used by the coach-makers. The third species will grow to about twelve feet; and the branches are numerous, smooth, and of a greenish colour. The leaves are smaller than those of the other sorts, though they are of a thicker texture, and of a lighter green. The flowers come out from the wings of the leaves, on slender foot-stalks: They are yellowish, appear early in the spring, and are succeeded by large yellow fruit.



*Propagation, &c.* All the species are propagated from seeds, which ripen in England, if they have a favourable autumn; but the foreign seeds are the most certain of producing a crop. These seeds should be sown, soon after they are ripe, either in boxes, or in a fine warm border of rich earth, a quarter of an inch deep; and in the following spring many of the young plants will appear; though a great part often lie till the second spring before they show their heads. If the seeds in the beds shoot early in the spring, they should be hooped, and protected by mats from the frosts, which would nip them in the bud. When all danger from frosts is over, the mats should be laid aside till the parching beams of the sun get powerful; when, in the day time, they may be laid over the hoops again, to screen the plants from injury. The mats should be constantly taken off every night, and the young plants should never be covered either in rainy or cloudy weather. During the whole summer, these seedlings should be frequently watered in dry weather, and the beds kept clean of weeds, &c. In the autumn, they must be protected from the frosts, which often come early in that season, and would not fail to destroy their tops. The like care should be continued all winter to defend them from the same enemies. In this seminary they may remain, being kept clean of weeds and watered in dry weather, till the end of June, when they should be taken out of their beds, and planted in others at six inches distance. And here let no one (continues Hanbury) be startled at my recommending the month of June for this work; for I have found by repeated experience, that the plants will be then almost certain of growing, and will continue their shoots till the autumn; whereas I have ever perceived, that many of those planted in March, have frequently perished, and that those which did grow made hardly any shoot that year, and showed the early figure of a stunted tree. In June, therefore, let the ground be well dug, and prepared for this work; and let the mould be rich and good: But the operation of removing must be deferred till rain comes; and if the season should be dry, this work may be postponed till the middle of July. After a shower, therefore, or a night's rain, let the plants be taken out of their beds, and pricked out at six inches distance from each other. After this, the beds in which they are planted should be hooped, and covered with mats when the sun shines; but these must always be taken away at night, as well as in rainy or cloudy weather. With this management, they will have shot to a good height by the autumn, and have acquired so much hardness and strength as to need no farther care than to be kept clear of weeds for two or three years; when they may by planted out in places where they are to remain, or set in the nursery, to be trained up for large standards. The best season for planting out these standard trees is the latter end of October, or beginning of November; and in performing that operation, the usual rules must be observed with care. The soil for the lote-tree should be light, and in good heart; and the situation ought to be well defended, the young shoots being very liable to be destroyed by the winter's frosts.

CEMENT, in a general sense, any glutinous substance capable of uniting and keeping things together in close cohesion. In this sense the word *cement* comprehends mortar, solder, glue, *&c.* but has been generally restrained to the compositions used for holding together broken glasses, china, and earthen ware. For this purpose the juice of garlic is recommended as exceedingly proper, being both very strong, and, if the operation is performed with care, leaving little or no mark. Quicklime and the white of an egg mixed together, and expeditiously used, are also very proper for this purpose. Dr Lewis recommends a mixture of quicklime and cheese, in the following manner: "Sweet cheese shaved thin and stirred with boiling hot water, changes into a tenacious slime which does not mingle with the water. Worked with fresh parcels of hot water, and then mixed upon a hot stone with a proper quantity of unslaked lime, into the consistence of a paste, it proves a strong and durable cement for wood, stone, earthen-ware, and glass. When thoroughly dry, which will be in two or three days, it is not in the least acted upon by water. Cheese barely beat with quicklime, as directed by some of the chemists for luting cracked glasses, is not near so efficacious." A composition of the drying oil of linseed and white-lead is also used for the same purposes, but is greatly inferior.

CEMENT in building, is used to denote any kind of mortar of a stronger kind than ordinary. The cement commonly used is of two kinds; hot, and cold. The hot cement is made of rosin, bees wax, brick dust, and chalk, boiled together. The bricks to be cemented are heated, and rubbed one upon another, with cement between them. The cold cement is that above described for cementing china, *&c.* which is sometimes, though rarely, employed in building.

The ruins of the ancient Roman buildings are found to cohere so strongly, that most people have imagined the ancients were acquainted with some kind of mortar, which, in comparison of ours, might justly be called *cement;* and that to our want of knowledge of the materials they used, is owing the great inferiority of modern buildings in their durability. In 1770, one M. Loriot, a Frenchman, pretended to have discovered the secret of the ancient cement, which, according to him, was no more than a mixture of powdered *quicklime* with lime which had been long slaked and kept under water. The slaked lime was first to be made up with sand, earth, brick-dust, *&c.* into mortar after the common method, and then about a third part of quick-lime in powder was added to the mixture. This produced an almost instantaneous petrification, something like what is called the *setting* of alabaster, but in a much stronger degree; and was possessed of many wonderful qualities needless here to relate, seeing it has never been known to succeed with any other person who tried it. Mr Anderson, in his essays on agriculture, has discussed this subject at considerable length, and seemingly with great judgment. He is the only person we know, who has given any rational theory of the uses of lime in building, and why it comes to be the proper basis of all cements. His account is in substance as follows:

Lime which has been slaked and mixed with sand, becomes hard and consistent when dry, by a process similar to that which produces the natural *stalactites* in caverns. These are always formed by water dropping from the roof. By some unknown and inexplicable process of nature, this water has dissolved in it a small portion of calcareous matter in a *caustic* state. As long as the water continues covered from the air, it keeps the earth dissolved in it; it being the natural property of calcareous earths, when deprived of their fixed air, to dissolve in water. But when the small drop of water comes to be exposed to the air, the calcareous matter contained in it begins to attract the fixable part of the atmosphere. In proportion as it does so, it also begins to separate from the water, and to reassume its native form of limestone or marble. This process Mr Anderson calls a *crystallization;* and when the calcareous matter is perfectly *crystallized* in this manner, he affirms that it is to all intents and purposes limestone or marble of the same consistence as before: and "in this manner (says he), within the memory of man, have huge rocks of marble been formed near Matlock in Derbyshire." If lime in a caustic state is mixed with water, part of the lime will be dissolved, and will also begin to crystallize. The water which parted with the crystallized lime, will then begin to act upon the remainder, which it could not dissolve before; and thus the process will continue, either till the lime be all reduced to an *effete*, or (as he calls it) *crystalline* state, or something hinders the action of the water upon it. It is this crystallization which is observed by the workmen when a heap of lime is mixed with water, and left for some time to macerate. A hard crust is formed upon the surface, which is ignorantly called *frosting*, though it takes place in summer as well as in winter. If therefore the hardness of the lime, or its becoming a cement, depends entirely on the formation of its crystals, it is evident, that the perfection of the cement must depend on the perfection of the crystals, and the hardness of the matters which are entangled among them. The additional substances used in making of mortar, such as sand, brick-dust, or the like, according to Mr Anderson, serve only for a purpose similar to what is answered by sticks put into a vessel full of any saline solution, namely, to afford the crystals an opportunity of fastening themselves upon it. If therefore the matter interposed between the crystals of the lime is of a friable, brittle nature, such as brick dust or chalk, the mortar will be of a weak and imperfect kind; but when the particles are hard, angular, and very difficult to be broken, such as those of river or pit-sand, the mortar turns out exceedingly good and strong. Sea-sand is found to be an improper material for mortar, which Mr Anderson ascribes to its being less angular than the other kinds. That the crystallization may be the more perfect, he also recommends a large quantity of water, that the ingredients be

Cement.

be perfectly mixed together, and that the drying be as slow as possible. An attention to these circumstances, he thinks, would make the buildings of the moderns equally durable with those of the ancients; and from what remains of the ancient Roman works, he thinks a very strong proof of his hypothesis might be adduced. The great thickness of their walls necessarily required a vast length of time to dry. The middle of them was composed of pebbles thrown in at random, and which have evidently had mortar so thin as to be *poured* in among them. By this means, a great quantity of the lime would be dissolved, and the crystallization performed in the most perfect manner; and the indefatigable pains and perseverance for which the Romans were so remarkable in all their undertakings, leave no room to doubt that they would take care to have the ingredients mixed together as well as possible. The consequence of all this is, that the buildings formed in this manner are all as firm as if cut out of a solid rock; the mortar being equally hard, if not more so, than the stones themselves.

Notwithstanding the bad success of those who have attempted to repeat M. Loriot's experiments, however, Dr Black informs us, that a cement of this kind is certainly practicable. It is done, he says, by powdering the lime while hot from the kiln, and throwing it into a thin paste of sand and water; which, not slaking immediately, absorbs the water from the mortar by degrees, and forms a very hard mass. "It is plain (he adds) that the strength of this mortar depends on using the lime hot or fresh from the kiln."

By mixing together gypsum and quick-lime, and then adding water, we may form a cement of tolerable hardness, and which apparently might be used to advantage in making troughs for holding water, or lining small canals for it to run in. Mr Wiegleb says, that a good mortar or cement, which will not crack, may be obtained by mixing three parts of a thin magma of slaked lime with one of powdered gypsum; but adds, that it is used only in a dry situation. A mixture of tarras with slacked lime acquires in time a stoney hardness, and may be used for preventing water from entering. See MORTAR and STUCCO.

CEMENT, among engravers, jewellers, *&c.* is the same with the hot cement used in building*; and is used for keeping the metals to be engraven firm to the block, and also for filling up what is to be chisseled.

* See the foregoing article.

CEMENT, in chemistry, is used to signify all those powders and pastes with which any body is surrounded in pots or crucibles, and which are capable by the help of fire of producing changes upon that body. They are made of various materials; and are used for different purposes, as for parting gold from silver, converting iron into steel, copper into brass: and by cementation more considerable changes can be effected upon bodies, than by applying to them liquids of any kind; because the active matters are then in a state of vapour, and assisted by a very considerable degree of heat.

*CEMENT which quickly hardens in Water.* This is described in the posthumous works of Mr Hooke, and is recommended for gilding live craw-fish, carps, *&c.* without injuring the fish. The cement for this purpose is prepared, by putting some Burgundy pitch into a new earthen pot, and warming the vessel till it receives so much of the pitch as will stick round it; then strewing some finely powdered amber over the pitch when growing cold, adding a mixture of three pounds of linseed oil, and one of oil turpentine, covering the vessel and boiling them for an hour over a gentle fire, and grinding the mixture as it is wanted with as much pumice-stone in fine powder as will reduce it to the consistence of paint. The fish being wiped dry, the mixture is spread upon it; and the gold leaf being then laid on, the fish may be immediately put into water again, without any danger of the gold coming off, for the matter quickly grows hard in the water.

Cement || Censer.

*CEMENT-Pots*, are those earthen pots used in the cementation of metals.

CEMENTATION, the act of corroding or otherwise changing a metal by means of a CEMENT.

CEMETERY (Κοιμητηριον, from Κοιμαω to "*sleep*;") a place set apart or consecrated for the burial of the dead.

Anciently none were buried in churches or churchyards: it was even unlawful to inter in cities, and the cemeteries were without the walls. Among the primitive Christians these were held in great veneration. It even appears from Eusebius and Tertullian, that, in the early ages, they assembled for divine worship in the cemeteries. Valerian seems to have confiscated the cemeteries and other places of divine worship, but they were restored again by Gallienus. As the martyrs were buried in these places, the Christians chose them for building churches on, when Constantine established their religion; and hence some derive the rule which still obtains in the church of Rome, never to consecrate an altar without putting under it the relics of some saint. The practice of consecrating cemeteries is of some antiquity. The bishop walked round it in procession, with the crozier or pastoral staff in his hand, the holy water-pot being carried before, out of which the aspersions were made.

CENCHRUS, in botany: A genus of the monœcia order, belonging to the polygamia class of plants; and in the natural method ranking under the 4th order, *Gramina.* The involucrum is laciniated, and echinated, or beset with small prickles, and biflorous. The calyx is a biflorous glume, with one floret-male, and the other hermaphrodite. The hermaphrodite corolla is a pointless glume; there are three stamina; one seed: the male corolla a pointless glume; with three stamina.

CENEGILD, in the Saxon Antiquities, an expiatory mulct, paid by one who had killed a man, to the kindred of the deceased. The word is compounded of the Saxon *cinne*, i. e. *cognatio*, "relation," and *gild*, *solutio*, "payment."

CENOBITE. See COENOBITE.

CENOTAPH, in antiquity, an empty tomb, erected by way of honour to the deceased. It is distinguished from a sepulchre, in which a coffin was deposited. Of these there were two sorts; one for those who had, and another for those who had not, been honoured with funeral rites in another place.

The sign whereby honorary sepulchres were distinguished from others, was commonly the wreck of a ship, to denote the decease of the person in some foreign country.

CENSER, in antiquity, a vase containing incense to be used in sacrifices. Censer is chiefly used in speaking

ing of the Jewish worship. Among the Greeks and Romans it is more frequently called *thuribulum*, λιβανωτις, and *acerra*.

The Jewish censer was a small sort of chafing-dish, covered with a dome, and suspended by a chain. Josephus tells us, that Solomon made twenty thousand gold censers for the temple of Jerusalem, to offer perfumes in, and fifty thousand others to carry fire in.

CENSIO, in antiquity, the act or office of the censor. See CENSUS.

Censio included both the rating or valuing a man's estate, and the imposing mulcts and penalties.

*Censio hastaria*, a punishment inflicted on a Roman soldier for some offence, as laziness or luxury, whereby his *hasta* or spear was taken from him, and consequently his wages and hopes of preferment stopped.

CENSITUS, a person censed, or entered in the censual table. See CENSUS.

In an ancient monument found at Ancyra, containing the actions of the emperor Octavius, we read,

> *Quo lustro civium Romanorum*
> *Censita sunt capita quadragies*
> *Centum millia & sexaginta tria.*

CENSITUS is also used in the civil law for a servile sort of tenant, who pays capitation to his lord for the land he holds of him, and is entered as such in the lord's rent-roll. In which sense, the word amounts to the same with *capite census*, or *capite censius*. See CAPITE *Censi*

CENSOR, (from *censere* to "see" or "perceive"), one of the prime magistrates in ancient Rome.—Their business was to register the effects of the Roman citizens, to impose taxes in proportion to what each man possessed, and to take cognizance or inspection of the manners of the citizens. In consequence of this last part of their office, they had a power to censure vice or immorality by inflicting some public mark of ignominy on the offender. They had even a power to create the *princeps senatus*, and expel from the senate such as they deemed unworthy of that office. This power they sometimes exercised without sufficient grounds; and therefore a law was at length passed that no senator should be degraded or disgraced in any manner, until he had been formally accused and found guilty by both the censors. It was also a part of the censorian jurisdiction, to fill up the vacancies in the senate, upon any remarkable deficiency in their number; to let out to farm all the lands, revenues, and customs, of the republic; and to contract with artificers for the charge of building and repairing all the public works and edifices both in Rome and the colonies of Italy. In all parts of their office, however, they were subject to the jurisdiction of the people; and an appeal always lay from the sentence of the censors to that of an assembly of the people.

The first two censors were created in the year of Rome 311, upon the senate's observing that the consuls were so much taken up with war, as not to have time to look into other matters. The office continued to the time of the emperors, who assumed the censorial power, calling themselves *morem præfecti*; though Vespasian, and his sons took the title of censors. Decius attempted to restore the dignity to a particular magistrate. After this we hear no more of it, till Constantine's time, who made his brother censor, and he seems to have been the last that enjoyed the office.



The office of censor was so considerable, that for a long time none aspired to it till they had passed all the rest; so that it was thought surprising that Crassus should be admitted censor without having been either consul or Prætor. At first the censors enjoyed their dignity for five years, but in 420 the dictator Mamertinus made a law restraing it to a year and an half, which was afterwards observed very strictly. At first one of the censors was elected out of a patrician, and the other out of a plebeian family; and upon the death of either, the other was discharged from his office, and two new ones elected, but not till the next lustrum. In the year of Rome 622, both censors were chosen from among the plebeians; and after that time the office was shared between the senate and people. —After their election in the Comitia Centurialia, the censors proceeded to the capitol, where they took an oath not to manage either by favour or disaffection, but to act equitably and impartially throughout the whole course of their administration.

The republic of Venice still has a censor of the manners of their people, whose office lasts six months.

*Censors of Books*, are a body of doctors or others established in divers countries, to examine all books before they go to the press, and to see they contain nothing contrary to faith and good manners.

At Paris the faculty of theology claim this privilege, as granted to them by the pope; but, in 1624, new commissions of four doctors were created, by letters-patent, the sole censors of all books, and answerable for every thing contained therein.

In England, they had formerly an officer of this kind, under the title of licenser of the press: but, since the revolution the press has been laid under no such restraint.

CENSORINUS, a celebrated writer in the third century, well known by his treatise *De Die Natali*. This treatise, which was written about the year 238, Gerard Vossius calls a little book of gold; and declares it to be a most learned work of the highest use and importance to chronologers, since it connects and determines with great exactness, some of the principal æras in pagan history. It was printed at Cambridge, with the notes of Lindenbrokius, in 1695.

CENSURE, a judgment which condemns some book, person, or action, or, more particularly, a reprimand from a superior. Ecclesiastical censures are penalties by which, for some remarkable misbehaviour, Christians are deprived of the communion of the church, or prohibited to execute the sacerdotal office.

CENSUS, in Roman antiquity, an authentic declaration made before the censors, by the several subjects of the empire, of their respective names and places of abode. This declaration was registered by the censors; and contained an enumeration, in writing, of all the estates, lands, and inheritances they possessed; their quantity, quality, place, wives, children, domestics, tenants, slaves. In the provinces the census served not only to discover the substance of each person, but where, and in what manner and proportion, taxes might be best imposed. The census at Rome is commonly thought to have been held every five years; but Dr Middleton hath shown, that both census and lustrum were held irregularly and uncertainly at various intervals. The census was an excellent expedient for discovering the strength of the state: for by it they discovered the number of the citizens, how many were fit for war, and how many for offices of other kinds; how much each was able to pay of taxes, *&c.* It went through all ranks of people, though under different names: that of the common people was called *census*; that of the knights, *census*, *recensio*, *recognitio*; that the senators, *lectio*, *relectio*.—Hence also *census* came to signify a person who had made such a declaration; in which sense it was opposed to *incensus*, a person who had not given in his estate, or name, to be registered.

The census, according to Salmasius, was peculiar to the city of Rome. That in the provinces was properly called *professio* and *απογραφη*. But this distinction is not every where observed by the ancients themselves.

Census was also used for the book or register wherein the professions of the people were entered: In which sense the census was frequently cited and appealed to, as evidence in the courts of justice.

Census is also used to denote a man's whole substance or estate.

*Census Senatorius*, the patrimony of a senator, which was limited to a certain value; being at first rated at eight hundred thousand sesterces, but afterwards, under Augustus, enlarged to twelve hundred thousand.

*Census Equester*, the estate or patrimony of a knight, rated at four hundred thousand sesterces, which was required to qualify a person for that order, and without which no virtue or merit was available.

Census was also used for a person worth an hundred thousand sesterces, or who was entered as such in the censual tables on his own declaration. In which sense, census amounts to the same with *classicus*, or a man of the first class; though Gellius limits the estate of those of this class to an hundred and twenty-five thousand asses. By the Voconian law, no census was allowed to give by his will above a fourth part of what he was worth to a woman.

Census was also used to denote a tax or tribute imposed on persons, and called also capitation. See *Capite Censi*.

*Census Dominicatus*, in writers of the lower age, denotes a rent due to the lord.

*Census Duplicatus*, a double rent or tax, paid by vassals to their lord on extraordinary or urgent occasions; as expeditions to the Holy Land, &c.

*Census Ecclesiæ Romanæ*, was an annual contribution voluntarily paid to the see of Rome by the several princes of Europe.

CENT, signifies properly an hundred, being an abridgement of the word *centum;* but is often used in commerce to express the profit or loss arising from the sale of any commodity: so that when we say there is 10 *per cent.* profit, or 10 *per cent.* loss, upon any merchandize that has been sold, it is to be understood, that the seller has either gained or lost ten pounds on every hundred pounds of the price at which he bought that merchandize; which is $\frac{1}{10}$ of profit, or $\frac{1}{10}$ of loss, upon the total of the sale.



CENTAUREA, in botany: A genus of the polygamia frustanea order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is bristly; the pappus simple; the corollulæ of the radius funnel-shaped, longer than those of the disk, and irregular.

CENTAUR, in astronomy, a part or moiety of a southern constellation, in form half-man half-horse; usually joined with the wolf. The word comes from *κενταυρος*, formed of *κεντεω*, *pungo; ταυρος*, *bull;* q. d. *bull pricker*. The stars of this constellation, in Ptolemy's Catalogue are 37; in Tycho's 4; and in the Britannic Catalogue, with Sharp's Appendix, 35.

CENTAURS, in mythology a kind of fabulous monsters, half men, and half horses. The poets pretend that the centaurs were the sons of Ixion and a cloud; the reason of which fancy is, that they retired to a castle called *νεφελη*, which signifies a "cloud."—This fable is differently interpreted; some will have the centaurs to have been a body of shepherds and herdsmen, rich in cattle, who inhabited the mountains of Arcadia, and to whom is attributed the invention of bucolic poetry. Palæphætus, in his book of incredibles, relates, that under the reign of Ixion, king of Thessaly, a herd of bulls on mount Thessaly run mad, and ravaged the whole country, rendering the mountains inaccessible; that some young men who had found the art of taming and mounting horses undertook to clear the mountains of these animals, which they pursued on horseback, and thence obtained the appellation of *Centaurs*. This success rendering them insolent, they insulted the Lapithæ, a people of Thessaly: and because when attacked they fled with great rapidity, it was supposed they were half horses and half men.—The Centaurs in reality were a tribe of Lapithæ, who inhabited the city Pelethronium adjoining to mount Pelion, and first invented the art of breaking horses, as is intimated by Virgil.

CENTAUREA, Greater Centaury: A genus of the polygamia frustanea order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is bristly, the pappus simple, the corollulæ of the radius funnel-shaped, longer than those of the disk, and irregular. There are 61 species. The root of one of them called *glastifolia*, is an article in the materia medica. It has a rough, somewhat acrid taste, and abounds with a red viscid juice. Its rough taste has gained it some esteem as an astringent; its acrimony as an aperient; and its glutinous quality as a vulnerary: but the present practice takes very little notice of it in any intention. Another of the species in the cyanus or blue bottle, which grows commonly among corn. The expressed juice of this flower stains linen of a beautiful blue colour, but is not permanent. Mr Boyle says that the juice of the inner petals, with a little alum, makes a beautiful permanent colour, equal to ultramarine.

*Lesser Centaury*. See Gentiana.

CENTELLA, in botany: A genus of the tetrandria order, belonging to the monœcia class of plants; and in the natural method ranking under the 11th order, *Sarmentaceæ*. The male involucrum is tetraphyllous and quinqueflorous, with four petals; the female in-

involucrum is diphyllous and uniflorous; the petals four; the germen inferior; two styles; and a bilocular seed-case.

CENTENARIUS, or CENTENARIO, in the middle age, an officer who had the government or command, with the administration of justice, in a village. The centenarii as well as vicarii were under the jurisdiction and command of the court. We find them among the Franks, Germans, Lombards, Goths, &c.

CENTENARIUS was also used for an officer who had the command of 100 men; most frequently called a CENTURION.

CENTENARIUS, in monasteries, was an officer who had the command of 100 monks.

CENTENINUM OVUM, among naturalists, denotes a sort of hen's egg much smaller than ordinary, vulgarly called a *cock's egg;* from which it has been fabulously held that the cockatrice or basilisk is produced. The name is taken from an opinion, that these are the last eggs which hens lay, having laid 100 before; whence *centeninum*, q. d. the hundredth egg.—These eggs have no yolks, but in other respects differ not from common ones; having the albumen, chalazes, membranes, &c. in common with others. In the place of the yolk is found a little body like a serpent coiled up, which doubtless gave rise to the fable of the basilisk's origin from thence. Their origin is with probability ascribed by Hervey to this, that the yolks in the vitellary of the hen are exhausted before the albumina.

CENTER, or CENTRE, in a general sense, signifies a point equally distant from the extremities of a line, figure, or body. The word is formed from the Greek κεντρον, a *point*.

*CENTER of Gravity*, in mechanics, that point about which all the parts of a body do in any situation exactly balance each other.

*CENTER of Motion*, that point which remains at rest, while all the other parts of a body move about it.

*CENTER of a Sphere*, a point in the middle, from which all lines drawn to the surface are equal.

Hermes Trismegistus defines God an intellectual sphere, whose center is every where, and circumference no where.

CENTESIMA USURA, that wherein the interest in an hundred months became equal to the principal; *i. e.* when the money is laid out at one *per cent.* per month; answering to what in our style would be called 12 *per cent.* for the Romans reckoned their interest not by the year, but by the month.

CENTESIMATION, a milder kind of military punishment, in cases of desertion, mutiny, and the like, where only every hundredth man is executed.

CENTILOQUIUM, denotes a collection of 100 sentences, opinions, or sayings.

The centiloquium of Hermes, contains 100 aphorisms, or astrological sentences, supposed to have been written by some Arab, falsely fathered on Hermes Trismegistus. It is only extant in Latin, in which it has several times been printed.—The centiloquium of Ptolemy is a famous astrological piece, frequently confounded with the former, consisting likewise of 100 sentences or doctrines, divided into short aphorisms, intitled also in Greek καρπὸς, as being the fruit or result of the former writings of that celebrated astronomer, *viz.* his *quadripartitum* and *almagestum*; or rather, by reason that herein is shown the use of astrological calculations.



CENTIPES, in zoology. See SCOLOPENDRA.

CENTIPED WORM, a term used for such worms as have a great many feet, though the number does not amount to 100, as the term seems to import.—M. Maloet relates the history of a man, who, for three years, had a violent pain in the lower part of the forehead near the root of the nose: at length he felt an itching, and afterwards something moving within his nostril, which he brought away with his finger; it was a worm of the centiped kind, an inch and an half long, which run swiftly. It lived five or six days among tobacco. The patient was free of his pain ever after. Mr Littre mentioned a like case in 1708, of a larger centiped voided at the nose, after it had thrown the woman, in whose frontal sinus it was, into convulsions, and had almost deprived her of her reason.

CENTLIVRE, (Susanna) a celebrated comic writer, was the daughter of Mr Freeman of Holbeach, in Lincolnshire, England; and had such an early turn for poetry, that it is said she wrote a song before she was seven years old. Before she was twelve years of age, she could not only read Moliere in French, but enter into the spirit of all the characters. Her father dying, left her to the care of a step-mother; whose treatment not being agreeable to her, she determined, though almost destitute of money and every other necessary, to go up to London to seek a better fortune than what she had hitherto experienced. As she was proceeding on her journey on foot, she was met by a young gentleman from the university of Cambridge, the afterwards well-known Anthony Hammond, Esq; who was so extremely struck with her youth and beauty, that he fell instantly in love with her; and inquiring into the particulars of her story, soon prevailed upon her unexperienced innocence to seize on the protection he offered her, and go with him to Cambridge. After some months cohabitation, he persuaded her to come to London; where, in a short time she was married to a nephew of Sir Stephen Fox. But that gentleman not living with her above a twelvemonth, her wit and beauty soon procured her a second husband, whose name was Carrol and who was an officer in the army; but he having the misfortune to be killed in a duel about a year and an half after their marriage, she became a second time a widow. For the sake of support she now applied to her pen, and became a votary of the muses; and it is under this name of Carrol that some of her earlier pieces were published. Her first attempt was in tragedy, in a play called the *Perjured Husband;* yet her natural vivacity leading her afterwards to comedy, we find but one more attempt in the buskin among 18 dramatic pieces which she afterwards wrote.

In 1706, she wounded the heart of one Mr Joseph Centlivre, yeoman of the mouth, or in other words principal cook to her Majesty, who married her; and, after passing several years happily together, she died at his house in Spring-Garden, Charing-Cross, in December 1723.

This lady for many years enjoyed the intimacy and esteem of the most eminent wits of the times, viz. Sir Richard Steele, Mr Rowe, Budgell, Farquhar, Dr Sewell, &c. and very few authors received more tokens of esteem and patronage from the great. With regard to her merit as a writer, it must be allowed that her plays do not abound with wit, and that the language of them is sometimes even poor, enervate, incorrect, puerile; but then her plots are busy and well conducted, and her characters in general natural and well marked.

CENTNER, or DOCIMASTIC HUNDRED, in metallurgy and assaying, is a weight divisible, first into an hundred, and thence into a greater number of other smaller parts; but though the word is the same both with the assayers and metallurgists, yet it is to be understood as expressing a very different quantity in their different acceptation of it. The weights of the metallurgists are easily understood, as being of the common proportion, but those of the assayers are a thousand times smaller than these, as the portions of metals or ores examined by the assayers are usually very small.

The metallurgists, who extract metals out of their ores, use a weight divided into an hundred equal parts, each part a pound; the whole they call a *centner* or *hundred weight*; the pound is divided into thirty-two parts, or half ounces, and the half ounce into two quarters of ounces, and these each into two drams.

These divisions and denominations of the metallurgists are easily understood; but the same words, tho' they are equally used by assayers, with them express very different quaintities; for as the centner of the metallurgists contains an hundred pounds, the centner of the assayers is really no more than one dram, to which the other parts are proportioned.

As the assayers weights are divided into such an extreme degree of minuteness, and are so very different from all the common weights, the assayers usually make them themselves in the following manner, out of small silver, or fine solder plates, of such a size, that the mark of their weight, according to the division of the dram, which is the *docimastic* or assaying *centner*, may be put upon them. They first take for a basis one weight, being about two-thirds of a common dram: this they mark (64*lb.*) Then having at hand some granulated lead, washed clean, well dried, and sifted very fine, they put as much of it into one of the small dishes of a fine balance as will equipoise the (64*lb.*) as it is called, just mentioned: then dividing this granulated lead into very nice halves, in the two scales, after taking out the first silver weight, they obtain a perfect equilibrium between the two scales; they then pour the granulated lead out of one dish of the scales, and instead of it put in another silver weight, which they make exactly equiponderant with the lead in the other scale, and mark it (32*lb.*) If this second weight, when first put into the scale, exceed by much the weight of the lead, they take a little from it by a very fine file; but when it comes very near, they use only a whetstone to wear off an extremely small portion at a time. When it is brought to be perfectly even and equal to the lead, they change the scales to see that no error has been committed, and then go on in the same manner till they have made all the divisions, and all the small weights. Then to have an entire centner or hundred weight, they add to the (64*lb.*) as they call it, a 32*lb.* and a 4*lb.* and weighing against them one small weight, they make it equal to them, and mark it (100). This is the docimastical, or assaying centner, and is really one dram.



CENTO, in poetry, a work wholly composed of verses or passages promiscuously taken from other authors, only disposed in a new form and order.—Proba Falconia has written the life of Jesus Christ in centos taken from Virgil. Alexander Ross has done the like in his Christrados, and Stephen de Pleure the same.

CENTONARII, in antiquity, certain of the Roman army, who provided different sorts of stuff called centones, made use of to quench the fire which the enemies engines threw into the camp.

These centonarii kept with the carpenters and other officers of artillery.

CENTRAL FORCES, the powers which cause a moving body to tend towards, or recede from, the center of motion. See MECHANICS.

*CENTRAL Rule*, a rule discovered by Mr Thomas Baker, whereby to find the centre of a circle designed to cut the parabola in as many points as an equation to be constructed hath real roots. Its principal use is in the construction of equations, and he hath applied it with good success as far as biquadratics.

The central rule is chiefly founded on this property of the parabola, that, if a line be inscribed in that curve perpendicular to any diameter, a rectangle formed of the segments of the inscript is equal to the rectangle of the intercepted diameter and parameter of the axis.

The central rule has the advantage over Cartes and De Latere's methods of constructing equations, in that both these are subject to the trouble of preparing the equation by taking away the second term.

CENTRIFUGAL FORCE, that force by which all bodies that move round any other body in a curve endeavour to fly off from the axis of their motion in a tangent to the periphery of the curve, and that in every part of it. See MECHANICS.

*CENTRIFUGAL-Machine*, a very curious machine, invented by Mr Erskine, for raising water by means of a centrifugal force combined with the pressure of the atmosphere.

It consists of a large tube of copper, *&c.* in the form of a cross, which is placed perpendicular in the water, and rests at the bottom on a pivot. At the upper part of the tube is a horizontal cog-wheel, which touches the cogs of another in a vertical position; so that by the help of a double winch, the whole machine is moved round with very great velocity.

Near the bottom of the perpendicular part of the tube is a valve opening upwards; and near the two extremities, but on the contrary sides of the arms, or cross part of the tube, are two other valves opening outwards. These two valves are, by the assistance of springs, kept shut till the machine is put in motion, when the centrifugal velocity of the water forces them open, and discharges itself in a cistern or reservoir placed there for that purpose.

On the upper part of the arms are two holes, which

Centrifugal.

are closed by pieces screwing into the metal of the tube. Before the machine can work, these holes must be opened, and water poured in through them, till the whole tube be full: by this means all the air will be forced out of the machine, and the water supported in the tube by means of the valve at the bottom.

The tube being thus filled with water, and the holes closed by their screw caps, it is turned round by means of the winch, when the water in the arms of the tube acquires a centrifugal force, opens the valves near the extremities of the arms, and flies out with a velocity nearly equal to that of the extremities of the said arms.

Plate CXXXVI.

The above description will be very easily understood by the figure we have added on Plate CXXXVI. which is a perspective view of the centrifugal machine, erected on board a ship. ABC is the copper tube. D, a horizontal cog-wheel, furnished with twelve cogs. E, a vertical cog-wheel, furnished with thirty-six cogs. F, F, the double winch. *a*, the valve near the bottom of the tube. *b*, *b*, the two pivots on which the machine turns. *c*, one of the valves in the cross-piece; the other at *d*, cannot be seen in this figure, being on the other side of the tube. *e*, *e*, the two holes through which the water is poured into the machine. GH, the cistern or reservoir. I, I, part of the ship's deck. The distance between the two valves, *c*, *d*, is six feet. The diameter of these valves is about three inches; and that of the perpendicular tube about seven inches.

If we suppose the men who work the machines can turn the winch round in three seconds, the machine will move round its axis in one second; and consequently each extremity of the arms will move with a velocity of 18.8 feet in a second. Therefore a column of water of three inches diameter will issue through each of the valves with a velocity of 18.8 feet in a second: but the area of the aperture of each of the valves is 7.14 inches; which being multiplied by the velocity in inches$=$225.6, gives 1610.784 cubic inches, the quantity of water discharged through one of the apertures in one second; so that the whole quantity discharged in that space of time through both the apertures is$=$3221.568 inches; or 193294.08 cubic inches in one minute. But 60812 cubic inches make a tun, beer-measure; consequently, if we suppose the centrifugal machine revolves round its axis in one second, it will raise nearly 3 tuns 44 gallons in one minute: but this velocity is certainly too great, at least to be held for any considerable time; so that, when this and other deficiences in the machine are allowed for, two tuns is nearly the quantity that can be raised by it in one minute.

It will perhaps be unnecessary to observe, that as the water is forced up the perpendicular tube by the pressure of the atmosphere, this machine cannot raise water above 32 feet high.

An attempt was made to substitute this machine in place of the pumps commonly used on ship-board, but the labour of working was found to be so great as to render the machine inferior to the chain-pump. A considerable improvement, we apprehend, would be, to load with a weight of lead the ends of the tubes thro' which the water issues, which would make the machine turn with a great deal more ease, as the centrifugal force of the lead would in some measure act the part of a fly.

Centripetal | Centurion.

CENTRIPETAL FORCE, that force by which a body is every where impelled, or any how tends, towards some point as a centre. See MECHANICS.

CENTRISCUS, in ichthyology, a genus of fishes belonging to the order of amphibia nantes. The head gradually ends in a narrow snout, the aperture is broad and flat; the belly is carinated; and the belly-fins united. There are two species, *viz.* 1. The scutatus has its back covered with a smooth bony shell, which ends in a sharp spine under which is the tail; but the back fins are between the tail and the spine. It is a native of the East Indies. 2. The scolopax has a rough scabrous body, and a straight extended tail. It has two belly-fins, with four rays in each, and has no teeth. It is found in the Mediterranean.

CENTRONIA, in natural history, a name by which the echini marini have been lately distinguished. Dr Hill makes them a distinct class of animals living under the defence of shelly coverings formed of one piece, and furnished with a vast number of spines moveable at the creature's pleasure.

CENTUMCELLÆ, (anc. geog.) Trajan's villa in Tuscany, on the coast, three miles from Algæ; with an excellent port, called *Trajanus Portus*, (Ptolemy); and a factitious island at the mouth of the port, made with a huge block of stone, on which two turrets rose, with two entrances into the bason or harbour, Rutilius. Now *Civita Vecchia*. E. Long. 12. 30 N. Lat. 42.

CENTUMVIRI, in Roman antiquity, judges appointed to decide common causes among the people: they were chosen, three out of each tribe; and though five more than an hundred, were nevertheless called *centumviri*, from the round number *centum*, an hundred.

CENTUNCULUS, in botany: A genus of the monogynia order, belonging to the tetrandria class of plants; and in the natural method ranking under the 20th order, *Rotaceæ*. The calyx is quadrifid; the corolla quadrifid, and patent; the stamina are short; the capsule is unilocular, cut round, or parting horizontally.

CENTURION, among the Romans, an officer in the infantry, who commanded a century, or an hundred men.

In order to have a proper notion of the centurions, it must be remembered, that every one of the thirty manipuli * in a legion was divided into two *ordines*, or ranks; and consequently the three bodies of the hastati, principes, and triarii, into 20 orders a piece, as into 10 manipuli. Now, every manipulus was allowed two centurions, or captains, one to each order or century: and, to determine the point of priority between them, they were created at two different elections. The 30 who were made first always took the precedency of their fellows: and therefore commanded the right-hand orders, as the others did the left. The triarii, or *pilani*, so called from their weapon the *pilum*, being esteemed the most honourable, had their centurions elected first, next to them the principes, and afterwards the hastati; whence they were called *primus et secundus pilus*, *primus et secundus princeps*, *primus et secundus hastatus*; and so on. Here it may be observed, that *primi ordines* is sometimes used in historians for the centurions

* See *Manipulus*.

rions of these orders; and the centurions are sometimes styled *principes ordinum*, and *principes centurionum*. We may take notice too what a large field there lay for promotion: first through all the orders of the hastati; then quite through the principes; and afterwards from the last order of the triarii to the primipilus, the most honourable of the centurions, and who deserves to be particularly described This officer, besides his title of primipilus, went under the several titles of *dux legionis*, *præfectus legionis*, *primus centurionum*, and *primus centurio*; and was the first centurion of the triarii in every legion. He presided over all the other centurions, and generally gave the word of command by order of the tribunes. Besides this, he had the care of the eagle, or chief standard, of the legion: hence, *aquilæ præesse*, is to bear the dignity of primipilus; and hence *aquila* is taken by Pliny for the said office. Nor was this station only honourable, but very profitable too: for he had a special stipend allowed him, probably as much as a knight's estate; and, when he left that charge, was reputed equal to the members of the equestrian order, bearing the title of *primipilarius*, in the same manner as those who had discharged the greatest civil offices were styled ever after, *consulares*, *censorii*, &c.

CENTURIPÆ, Centoripa, or Centuripe, (anc. geog) a town in the south-west of the territory of Etna, on the river Cyamasorus: Now *Centorbi*, or *Centurippi*. It was a democratical city, which, like Syracuse, received its liberty from Timoleon. Its inhabitants cultivated the fine arts, particularly sculpture and engraving. In digging for the remains of antiquities, cameos are no where found in such abundance as at Centurippi and its environs. The situation of the place is romantic: it is built on the summit of a vast group of rocks, which was probably chosen as the most difficult of access, and consequently the properest in times of civil commotion. The remains still existing of its ancient bridge are a proof of its having been a considerable city. Cicero speaks of it as such. It was taken by the Romans, plundered and oppressed by Verres, destroyed by Pompey, and restored by Octavius, who made it the residence of a Roman colony.

CENTURY, in a general sense, any thing divided into, or consisting of, an hundred parts.

The marquis of Worcester published a *Century* of inventions, (for a specimen of which, see Acoustics, n° 27.); and Dr Hooke has given a *decimate* of inventions, as part of a *Century*, of which he affirmed himself master. It is remarkable, that both in the century of the former, and the decimate of the latter, we find the principle on which Savary's fire or steam engine is founded. See *Steam-Engine*.

Century in antiquity. The Roman people, when they were assembled for the electing of magistrates, enacting of laws, or deliberating upon any public affair, were always divided into centuries, and voted by centuries, in order that their votes might be the more easily collected, whence these assemblies were called *comitia centuriata*. The Roman cohorts were also divided into centuries. See Centurion and Cohort.

Century, in chronology, the space of one hundred years. This method of computing by centuries is generally observed in church history, commencing from the time of our Saviour's incarnation: in which sense we say the first century, the second century, &c.



*Centuries of Magdeburg*, a famous ecclesiastical history, ranged into 13 centuries, carried down to the year 1298, compiled by several hundred protestants of Magdeburg, the chief of whom was Flacius Illyricus.

CENTUSSIS, in Roman antiquity, a coin containing 100 asses.

CENTZONTLI, in ornithology, the Mexican name of the *Turdus polyglottus*. See Turdus.

CEODES, in botany: A genus of the diœcia order, belonging to the polygamia class of plants. There is no calyx; the corolla is monopetalous, with a short turbinated tube; the stamina are ten subulated filaments; the antheræ roundish.

CEORLES, the name of one of the classes or orders into which the people were distinguished among the Anglo-Saxons. The ceorles, who were persons completely free, and descended from a long race of freemen, constituted a middle class between the labourers and mechanics (who were generally slaves, or descended from slaves) on the one hand, and the nobility on the other. They might go where they pleased, and pursue any way of life that was most agreeable to their humour; but so many of them applied to agriculture, and farming the lands of the nobility, that a ceorl was the most common name for a husbandman or farmer in the Anglo-Saxon times. These ceorls, however, seem in general to have been a kind of gentlemen farmers; and if any one of them prospered so well as to acquire the property of five hides of land, upon which he had a church, a kitchen, a bell-house, and great gate, and obtained a seat and office in the king's court, he was esteemed a nobleman or thane. If a ceorl applied to learning, and attained to priest's orders, he was also considered as a thane; his weregild, or price of his life, was the same, and his testimony had the same weight in a court of justice. When he applied to trade, and made three voyages beyond sea, in a ship of his own, and with a cargo belonging to himself, he was also advanced to the dignity of a thane. But if a ceorl had a greater propensity to arms than to learning, trade, or agriculture, he then became the sithcundman, or military retainer, to some potent and warlike earl, and was called the *huscarle* of such an earl. If one of these huscarles acquitted himself so well as to obtain from his patron either five hydes of land, or a gilt sword, helmet, and breastplate, as a reward of his valour, he was likewise considered as a thane. Thus the temple of honour stood open to these ceorls, whether they applied themselves to agriculture, commerce, letters, or arms, which were then the only professions esteemed worthy of a freeman.

CEOS, Cea, Cia, or Cos, (anc. geog.) one of the Cyclades, lies opposite to the promontory of Achaia called *Sunium*, and is 50 miles in compass. This island is commended by the ancients for its fertility and richness of its pastures. The first silk stuffs, if Pliny and Solinus are to be credited, were wrought here. Ceos was particularly famous for the excellent figs it produced. It was first peopled by Aristæus, the son of Apollo and Cyrene, who, being grieved for the death of his son Actæon, retired from Thebes, at the persuasion of his mother, and went over with some Thebans

bans to Ceos, as that time uninhabited. Diodorus Siculus tells us, that he retired to the island of Cos; but the ancients, as Servius observes, called both these islands by the name Cos. Be that as it will, the island of Ceos became so populous, that a law prevailed there, commanding all persons upwards of sixty to be poisoned, that others might be able to subsist; so that none above sixty were to be seen in the island, being obliged, after they arrived at that age, either to submit to the law, or abandon the country, together with their effects. Ceos had, in former times, four famous cities, viz. Julis, Carthæa, Coressus, and Præessa. The two latter were, according to Pliny, swallowed up by an earthquake. The other two flourished in Strabo's time. Carthæa stood on a rising ground, at the end of a valley, about three miles from the sea. The situation of it agrees with that of the present town of Zia, which gives name to the whole island. The ruins both of Carthæa and Julis are still remaining; those of the latter take up a whole mountain, and are called by the modern inhabitants Polis, that is, *the city*. Near this place are the ruins of a stately temple, with many pieces of broken pillars, and statues of most exquisite wormanship. The walls of the city were of marble, and some pieces are still remaining above 12 feet in length. Julis was, according to Strabo, the the birth place of Simonides, Bacchylides, Erasistratus, and Aristo. The Oxford marbles tell us, that Simonides, the son of Leoprepis, invented a sort of artificial memory, the principles of which he explained at Athens, and add, that he was descended of another Simonides, who was a poet no less renowned than himself. One of these two poets invented those melancholly verses which were sung at funerals, and are called by the Latins *næniæ*. Strabo says, that the Athenians, having besieged the city of Julis, raised the siege, upon advice that the inhabitants had resolved to murder all the children under a certain age, that useful persons might not be employed in looking after them. Ceos was, with the other Greek islands, subdued by the Romans, and bestowed upon the Athenians by Marc Anthony the triumvir, together with Egina, Tinos, and some other adjoining islands, which were all reduced to one Roman province by Vespasian. The island is now called *Zea*.

CEPA, the ONION. See ALLIUM.

CEPHALANTHUS, BUTTON-WOOD: A genus of the monogynia order, belonging to tetrandria class of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. There is no common calyx; the proper one is superior, and funnel-shaped; the receptacle globose and naked, with one downy seed. There is only one species, the *Occidentalis*; a deciduous shrub, native of North-America. It grows to about five or six feet high; and is not a very bushy plant, as the branches are always placed thinly in proportion to the size of the leaves, which will grow more than three inches long, and one and a half broad, if the trees are planted in a soil they like. The leaves stand opposite by pairs on the twigs, and also sometimes by threes, and are of a light green colour: Their upper surface is smooth; they have a strong nerve running from the foot-stalk to the point, and several others from that on each side to the borders: These, as well as the foot-stalk, in the autumn dye to a reddish colour. The flowers, which are aggregate flowers, properly so called, are produced at the ends of the branches, in globular heads, in July. The florets which compose these heads are funnel-shaped, of a yellow colour, and fastened to an axis which is in the middle.—The cephalanthus is propagated from seeds, which are exported to Great-Britain. These should be sown as soon as they arrive, and there will be a chance of their coming up the first spring; though they often lie till the spring after before they make their appearance. They may be sown in good garden mould of almost any soil, if somewhat moist the better, and should be covered about a quarter of an inch deep. This shrub is also propagated by layers. If the young shoots are laid in autumn, they will have struck good root by the autumn following, and may be then taken up, and set in the places where they are designed to remain. Cuttings of this tree, also, planted in the autumn in a rich, light, moist soil, will grow; and by that means also plenty of these plants may be soon obtained.



CEPHALIC, in a general meaning, signifies any thing belonging to the head.

*CEPHALIC Medicines*, are remedies for disorders of the head. Cordials are comprehended herein, as are also whatever promotes a free circulation of the blood through the brain.

Except when the disorder arises from excess of heat, or an inflammatory dispsition in the head, moist topicals should never be used; but always dry ones.

To rub the head after it is shaved proves an instantaneous cure for a cephalalgia, a stuffing of the head, and a weakness of the eyes, arising from a weak and relaxed state of the fibres. And as by every fresh evacuation of the humours their quantity is not only lessened, but also their recrementitious parts derived thither, the more frequently the head is shaved, the larger quantity of humour is discharged; so that the frequent shaving of the head and beard is likewise a perpetual blister; and in as much as it is useful, it is a cephalic.

*CEPHALIC Vein*, in anatomy, creeps along the arm between the skin and the muscles, and divides it into two branches: the external goes down to the wrist, where it joins the basilica, and turns up to the back of the hand; the internal branch, together with a small one of the basilica, makes the mediana.

The ancients used to open this vein for disorders of the head, for which reason it bears this name; but a better acquaintance with the circulation of the blood informs us, that there is no foundation for such a notion.

CEPHALENIA, or CEPHALLENIA, an island of the Ionian sea between Ithaca and Zacynthus, known in Homer's time by the names of Samus and Epirus Melæna, is about eighty miles in length, forty in breadth, and a hundred and thirty in compass. It had anciently four cities, one of which bore the name of the island. Strabo tells us, that in his time there were only two cities remaining; but Pliny speaks of three; adding, that the ruins of Same, which had been destroyed by the Romans, were still in being. Same was the metropolis of the island, and is supposed to have stood in the place which the Italians call Porto Guiscardo. The names of the four cities were, according to Thucydides, Same, Prone, Cranii, and Palæ. This island was subdued by the Thebans, under the conduct of Amphitryo, who is said to have killed Pterelas, who then reigned here. While Amphitryo was carrying on the war in Cephalenia, then called Samos, one Cephalus, a man of great distinction at Athens, having accidentally killed his wife Procris in shooting at a deer, fled to Amphitryo, who, pitying his case, not only received him kindly, but made him governor of the island, which thenceforth was called Cephalenia. After it had been long in subjection to the Thebans, it fell under the power of the Macedonians, and was taken from them by the Ætolians, who held it till it was reduced by M. Fulvius Nobilior, who, having gained the metropolis after a four months siege, sold all the citizens for slaves, adding the whole island to the dominions of his republic. Now called CEPHALONIA.

CEPHALONIA, the capital of an island of the same name, situated in the Mediterranean, near the coast of Epirus, and subject to the Venetians. E. Long. 21. N. Lat. 30. 30.

CEPHEUS, in fabulous history, a king of Arcadia, on whose head Minerva fastening one of Medusa's hairs, he was rendered invincible.

CEPHEUS, in astronomy, a constellation of the northern hemisphere. See ASTRONOMY, n° 406.

CERAM, an island in the Indian ocean, between the Molucca islands on the north, and those of Ambona and Banda on the south, lying between E. Long. 126. and 129. in S. Lat. 3. It is about 150 miles long, and 60 broad; and here the Dutch have a fortress, which keeps the natives in subjection.

CERAMBYX, in zoology, a genus of insects of the beetle kind, belonging to the order of insecta coleopatera. The antennæ are long and small; the breast is spinous or gibbous; and the elytra are linear. There are no less than 83 species enumerated by Linnæus, principally distinguished by the figure of the breast.

CERASTES, in zoology, the trivial name of species of ANGUIS and COLUBER.

CERASTIUM, MOUSE-EAR: A genus of the pentagynia order, belonging to the decandria class of plants; and in the natural method ranking under the 22d order, *Caryophylleæ*. The calyx is pentaphyllous; the petals are bifid; the capsule is unilocular, and opening at the top. There are 16 species, but none of them possessed of any remarkable property.

CERASUS, in botany. See PRUNUS.

CERATE, in pharmacy, a thickish kind of ointment, applied to ulcerations, excoriations, &c. See PHARMACY, *Index*.

CERATION, the name given by the ancients to the small seeds of Ceratonia, used by the Arabian physicians as a weight to adjust the doses of medicines; as the grain weight with us took its rise from a grain of barley.

CERATON, or *ceratium*, was also a silver coin, equal to one-third of an obolus.

CERATOCARPUS, in botany: A genus of the monandria order, belonging to the monœcia class of plants; and in the natural method ranking under the 12th order, *Holoraceæ*. The male calyx is bipartite; there is no corolla; the filament is long: The female calyx is diphyllous, and grown to the germen; there is no corolla; the styles are two; the seed is two-horned and compressed.



CERATONIA, the CAROB TREE, or *St John's bread*: A genus of the polyæcia order, belonging to the polygamia class of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The calyx is hermaphrodite and quinquepartite; there is no corolla; the stamina are five; the style is filiform; the legumen coriaceous and polyspermous. It is also diœcious, or male and female distinct on different plants. There is but one species, the siliqua, a native of Spain, of some parts of Italy and the Levant. It is an ever-green; and, in the countries where it is a native, grows in the hedges. It produces a quantity of long, flat, brown-coloured pods, which are thick, meally, and of a sweetish taste. These pods are many times eaten by the poorer sort of inhabitants when there is a scarcity of other food; but they are apt to loosen the belly, and cause gripings of the bowels. They are called *St John's-bread*, from an ill-founded assertion of some writers on scripture, that these pods were the locusts St John eat with his honey in the wilderness. The tree may be propagated in England from seeds, which are to be sown in a moderate hot-bed, and the plants inured to the open air by degrees.

CERATOPHYLLUM, in botany: a genus of the polyandria order, belonging to the monœcia class of plants; and in the natural method ranking under the 15th order, *Inundatæ*. The male calyx is multipartite; no corolla; stamina from 16 to 20: the female calyx is multipartite; no corolla; one pistil; no style; one naked seed.

CERAUNIA, CERAUNIAS, or CERAUNIUS *Lapis*, in natural history, a sort of flinty stone, of no certain colour, but of a pyramidal or wedge-like figure; popularly supposed to fall from the clouds in the time of thunder-storms, and to be possessed of divers notable virtues, as promoting sleep, preserving from lightning, &c. The word is from the Greek κεραυνος, *thunderbolt*. The ceraunia is the same with what is otherwise called the thunder-stone, or thunder-bolt; and also sometimes *sagitta*, or arrow's-head, on account of its shape. The ceranniæ are frequently confounded with the ombriæ and brontiæ, as being all supposed to have the same origin. The generality of naturalists take the ceraunia for a native stone, formed among the Pyrites, of a saline, concrete, mineral juice. Mercatus and Dr Woodward assert it to be artificial, and to have been fashioned thus by tools. The ceraunia, according to these authors, are the heads of the ancient weapons of war, in use before the invention of iron; which, upon the introduction of that metal, growing into disuse, were dispersed in the fields through this and that neighbouring country. Some of them had possibly served in the early ages for axes, others for wedges, others for chissels; but the greater part for arrow-heads, darts, and lances. The ceraunia is also held by Pliny for a white or crystal-coloured gem, that attracted lightning to itself. What this was, is hard to say. Prudentius also speaks of a yellow ceraunia; by which he is supposed to mean the carbuncle or pyropus.

CERBERA, in botany: A genus of the monogynia

nia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 30th order, *Contortæ*. The fruit is a monoſpermous plum. The moſt remarkable ſpecies is the *atroucer*, a native of the warm parts of America. It riſes with an irregular ſtem to the height of eight or ten feet, ſending out many crooked diffuſed branches, which towards their tops are garniſhed with thick ſucculent leaves of a lucid green, ſmooth, and very full of a milky juice. The flowers come out in looſe bunches at the end of the branches; they are of a cream colour, having long narrow tubes, and at the top are cut into five obtuſe ſegments, which ſeem twiſted, ſo as as ſtand oblique to the tube. The wood of this tree ſtinks moſt abominably, and the kernels of the nuts are a deadly poiſon to which there is no antidote; ſo that the Indians will not even uſe the wood for fuel.

CERBERUS, in fabulous hiſtory, a dreadful three-headed maſtiff, born of Typhon and Echidna, and placed to guard the gates of hell. He fawned upon thoſe who entered, but devoured all who attempted to get back. He was, however, maſtered by Hercules, who dragged him up to the earth, when, in ſtruggling, a foam dropped from his mouth, which produced the poiſonous herb called *aconite* or *wolf's-bane*.

Some have ſuppoſed that Cerberus is the ſymbol of the earth, or of all-devouring time; and that its three mouths repreſent the preſent, paſt, and future. The victory obtained by Hercules over this monſter, denotes the conqueſt which this hero acquired over his paſſions. Dr Bryant ſuppoſes that Cerberus was the name of a place, and that it ſignified the temple of the Sun; deriving it from *Kir-Abor, the place of light*. This temple was alſo called *Tor-Caph-El*, which was changed to τρικηφαγος; and hence Cerberus was ſuppoſed to have had three heads. It was likewiſe called *Tor-Keren, Turris Regia;* whence τρι καρηνος, from τρεις, *three*, and καρηνον, *head*.

CERCÉLE, in heraldry: a croſs cercele is a croſs which, opening at the ends, turns round both ways like a ram's horn. See CROSS.

CERCIS, the JUDAS-TREE: A genus of the monogynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The calyx is quinquedentated, and gibbous below; the corolla papilionaceous, with a ſhort vexillum or flag-petal under the wings or ſide-petals: a leguminous plant. There are only two ſpecies, both deciduous.

1. The ſiliquaſtrum, common Judas-tree, or Italian cercis, a native of Italy and other parts of the ſouth of Europe.—Theſe differ in the height of their growth in different places: In ſome they will arrive to be fine trees, of near twenty feet high; whilſt in others they will not riſe to more then ten or twelve feet, ſending forth young branches irregularly from the very bottom. The ſtem of this tree is of a dark-greyiſh colour, and the branches, which are few and irregular, have a purpliſh caſt. The leaves are ſmooth, heart-ſhaped, and roundiſh, of a pleaſant green on their upper ſurface, hoary underneath, and grow alternately on long foot-ſtalks. The flowers are of a fine purple: They come out early in the ſpring, in cluſters, from the ſide of the branches, growing upon ſhort foot-ſtalks; and in ſome ſituations they are ſucceeded by long flat pods, containing the ſeeds, which, in very favourable ſeaſons, ripen in England. Some people are fond of eating theſe flowers in ſallads, on which account alone in ſome parts this tree is propagated. The varieties of this ſpecies are, 1. The Fleſh-coloured: 2. The White-flowered; and, 3. The Broad-podded Judas-tree.

2. The Canadenſis, or Canadian cercis, will grow to the ſize of the firſt ſort in ſome places. The branches are alſo irregular. The leaves are cordated, downy, and placed alternately. The flowers uſually are of a paliſh red colour, and ſhow themſelves likewiſe in the ſpring, before the leaves are grown to their ſize. Theſe too are often eaten in ſallads, and afford an excellent pickle. There is a variety of this with deep red, and another with purple flowers. The pleaſure which theſe trees will afford in a plantation may be eaſily conceived, not only as they exhibit their flowers in cluſters, in different colours, early in the ſpring, before the leaves are grown to ſuch a ſize as to hide them; but from the difference of the upper and lower ſurface of the leaves; the one being of a fine green, the other of a hoary caſt; ſo that on the ſame tree, even in this reſpect, is ſhown variety; an improvement whereof is made by the waving winds, which will preſent them alternately to view.

*Propagation.* As theſe ſpecies will not take root by layers, they muſt be propagated by ſeeds, which may be had from abroad. They are generally brought us ſound and good, and may be ſown in the months of February or March. Making any particular compoſt for their reception is unneceſſary; common garden mould, of almoſt every ſort, will do very well: And this being well dug, and cleared of all roots, weeds, &c. lines may be drawn for the beds. The mould being fine, part of it ſhould be taken out, and ſifted over the ſeeds, after they are ſown, about half an inch thick. Part of the ſeeds will come up in the ſpring, and the others will remain until the ſpring following; ſo that whoever is deſirous of drawing the ſeedlings of a year old to plant out, muſt not deſtroy the bed, but draw them carefully out, and after that there will be a ſucceeding crop. However, be this as it will, the ſeeds being come up, they muſt be weeded, and encouraged by watering in the dry ſeaſon; and they will require no farther care during the firſt ſummer. In the winter alſo they may be left to themſelves, for they are very hardy; though not ſo much but that the ends of the branches will be killed by the froſt, nay, ſometimes to the very bottom of the young plant, where it will ſhoot out again afreſh in the ſpring. Whoever, therefore, is deſirous of ſecuring his ſeedling-plants from this evil, ſhould have his beds hooped, in order to throw mats over them during the hard froſts. Toward the latter end of March, or beginning of April the plants having been in the ſeed-bed one or two years, they ſhould be taken out, and planted in the nurſery: The diſtance of one foot aſunder, and two feet in the rows, ſhould be given them. Hoeing the weeds down in the ſummer muſt alſo be allowed, as well as digging between the rows in the winter. Here they may ſtand until they are to be removed finally; but they muſt be gone over in the winter with the knife, and ſuch irregular branches taken off as are produced near the root; by which management the tree may be trained up to a regular stem. Such, continues Hanburry is the culture of the species of cercis; sorts that are not to be omitted where there are any pretensions to a collection. Besides, the wood itself is of great value; for it polishes exceedingly well, and is admirably veined with black and green.

CERCOPITHECI, in natural history, the name given by Mr Ray to monkeys, or the class of apes with long tails. See APE and SIMIA.

CERDA, (John Lewis de la) a learned Jesuit of Toledo, wrote large commentaries on Virgil, which have been much esteemed; also several other works. He died in 1643, aged 80.

CERDONIANS, ancient heretics, who maintained most of the errors of Simon Magus, Saturninus, and the Manichees. They took their name from their leader *Cerdon*, a Syrian, who came to Rome in the time of pope Hyginus, and there abjured his errors: but in appearance only; for he was afterwards convicted of persisting in them, and accordingly cast out of the church again. Cerdon asserted two principles, the one good and the other evil: this last, according to him, was the creator of the world, and the god that appeared under the old law. The first, whom he called *unknown*, was the father of Jesus Christ; who, he taught, was incarnate only in appearance, and was not born of a virgin; nor did he suffer death but in appearance. He denied the resurrection; and rejected all the books of the Old Testament, as coming from an evil principle. Marcion, his disciple, succeeded him in his errors.

CEREALIA, in antiquity, feasts of Ceres, instituted by Triptolemus, son of Celeus king of Eleusine in Attica, in gratitude for his having been instructed by Ceres, who was supposed to have been his nurse, in the art of cultivating corn and making bread.

There were two feasts of this kind at Athens; and one called *Eleusinia*, the other *Thesmophoria*. See the article ELEUSINIA. What both agreed in, and was common to all *cerealia*, was, that they were celebrated with a world of religion and purity; so that it was esteemed a great pollution to meddle, on those days, in conjugal matters. It was not Ceres alone that was honoured here, but also Bacchus. The victims offered were hogs, by reason of the waste they make in the products of the earth: whether there was any wine offered or not, is matter of much debate among the critics. Plautus and Macrobius seem to countenance the negative side; Cato and Virgil the positive. Macrobius says, indeed, they did not offer wine to Ceres, but *mulsum*, which was a composition of wine and honey boiled up together: that the sacrifice made on the 21st of December to that goddess and Hercules, was a pregnant sow, together with cakes and mulsum; and that this is what Virgil means by *Mili Baccho*. The *cerealia* passed from the Geeks to the Romans, who held them for eight days successively; commencing, as generally held, on the fifth of the ides of April. It was the women alone who were concerned in the celebration, all dressed in white: the men, likewise in white, were only spectators. They eat nothing till after sun-set; in memory of Ceres, who in her search after her daughter took no repast but in the evening.



After the battle of Cannæ, the desolation was so great at Rome, that there were no women to celebrate the feast, by reason they were all in mourning; so that it was omitted that year.

CEREALIA, in botany, from *Ceres* the goddess of corn; Linnæus's name for the larger esculent seeds of the grasses: these are rice, wheat, rye, barley, oats, millet, panic grass, Indian millet, holcus, zizania, and maize. To this head may be likewise referred darnel, *(lolium)*; which, by preparation, is rendered esculent.

CEREBELLUM, the hinder part of the head. See ANATOMY, n° 133.

CEREBRUM, the BRAIN. Its structure and use are not so fully known as some other parts of the body, and different authors consider it in various manners. However, according to the observations of those most famed for their accuracy and dexterity in anatomical inquiries, its general structure is as given in ANATOMY, n° 132.

Dr Hunter observes, that the principal parts of the medullary substance of the brain in ideots and madmen, such as the *thalami nervorum opticorum* and *medulla oblongata*, are found entirely changed from a medullary to a hard, tough, dark-coloured substance, sometimes resembling white leather.

CEREMONIAL, (*ceremoniale*) a book in which is prescribed the orders of the ceremonies to be observed in certain actions and occasions of solemnity and pomp. The ceremonial of the Roman church is called *ordo Romanus*. It was published in 1516 by the bishop of Corcyra; at which the college of cardinals were so scandalized, that some of them voted to have the author as well as book burnt, for his temerity in exposing the sacred ceremonies to the eyes of profane people.

CEREMONIAL is also used for the set or system of rules and ceremonies which custom has introduced for regulating our behaviour, and which persons practise towards each other, either out of duty, decency, or civility.

CEREMONIAL, in a more particular sense, denotes the manner in which princes and ambassadors use to receive and to treat one another. There are endless disputes among sovereigns about the *ceremonial*: some endeavouring to be on a level, and others to be superior; insomuch that numerous schemes have been proposed for settling them. The chief are, 1. To accommodate the difference by compromise or alternation, so that one shall precede now, the other the next time; or one in one place, and the other in another; 2. By seniority; so that an elder prince in years shall precede a younger, without any other distinction. These expedients, however, have not yet been accepted of by any, except some *alternate princes*, as they are called, in Germany.

CEREMONIAL is more particularly used in speaking of the laws and regulations given by Moses relating to the worship of God among the ancient Jews. In this sense it amounts to much the same with what is called the *Levitical law*, and stands contradistinguished from the moral as well as judicial law.

CEREMONY, an assemblage of several actions, forms, and circumstances, serving to render a thing more magnificent and solemn.

In 1646, M. Ponce published a history of ancient ceremonies, tracing the rise, growth, and introduction of of each rite into the church, and its gradual advancement to superstition therein. Many of them were borrowed from Judaism; but more seemingly from Paganism. Dr Middleton has given a fine discourse on the conformity between the pagan and popish ceremonies, which he exemplifies in the use of incense, holy water, lamps, and candles, before the shrines of saints, votive gifts or offerings round the shrines of the deceased, &c. In effect, the altars, images, crosses, processions, miracles, and legends; nay, even the very hierarchy, pontificate, religious orders, &c. of the present Romans, he shows, are all copied from their heathen ancestors.—We have an ample and magnificent account of the religious ceremonies and customs of all nations in the world, represented in figures designed by Picart, with historical explanations, and many curious dissertations.

*Master of the* CEREMONIES, an officer instituted by king James I. for the more honourable reception of ambassadors and strangers of quality. He wears about his neck a chain of gold, with a medal under the crown of Great Britain, having on one side an emblem of peace, with this motto, *Beati pacifici*; and on the other, an emblem of war, with *Dieu et mon droit:* his salary is 300*l. per annum.*

*Assistant Master of the* CEREMONIES, is to execute the employment in all points, whensoever the master of the ceremonies is absent. His salary is 141*l.* 13*s.* and 4*d. per annum.*

*Marshall of the* CEREMONIES is their officer, being subordinate to them both. His salary is 100*l. per annum.*

CERENZA, a town of Italy in the kingdom of Naples, and in the Hither Calabria, with a bishop's see. It is seated on a rock, in E. Long. 17. 5. N. Lat. 39. 23.

CERES, a Pagan deity, the inventor or goddess of corn; in like manner as Bacchus was of wine.

According to the poets, she was the daughter of Saturn and Ops, and the mother of Proserpine, whom she had by Jupiter. Pluto having stolen away Proserpine, Ceres travelled all over the world in quest of her daughter, by the help of a torch, which she had lighted in Mount Ætna.

As Ceres was thus travelling in search of her daughter, she came to Celeus king of Eleusis, and undertook to bring up his infant son Triptolemus. Being desirous to render her charge immortal, she fed him in the day-time with divine milk, and in the night covered him with fire. Celeus observing an unusual improvement in his son, resolved to watch his nurse, to which end he hid himself in that part of the house where she used to cover the child with fire; but when he saw her put the infant under the embers, he cried out and discovered himself. Ceres punished the curiosity and indiscretion of the father with death. Afterwards she taught the youth the art of sowing corn and other fruits, and mounted him in a chariot drawn by winged dragons, that he might traverse the world, and teach mankind the use of corn and fruits. After this, having discovered, by means of the nymph Arethusa, that Proserpine was in the infernal regions, she applied to Jupiter, and obtained of him that Proserpine should be restored, on condition that she had tasted nothing during her stay in that place: but it being discovered, by the information of Ascalaphus, that, as she was walking in Pluto's orchard, she had gathered an apple, and had tasted of some of the seeds, she was for ever forbidden to return. Ceres, out of revenge, turned Ascalaphus into an owl. At length, Jupiter, to mitigate her grief, permitted that Proserpine should pass one half of the year in the infernal regions with Pluto, and the other half with her mother on earth.

Cicero speaks of a temple of Ceres at Catanea in Sicily, where was a very ancient statue of that goddess, but entirely concealed from the sight of men, every thing being performed by matrons and virgins.

CERET, a town of France in Roussillon, with a magnificent bridge of a single arch. It is seated near the river Tec, in E. Long. 2. 46. N. Lat. 42. 23.

CEREUS, in botany. See CACTUS.

CERIGO, an island in the Archipelago, anciently called *Cytherea*; noted for being the birth-place of Helen, and, as the poets say, of Venus. At present, there is nothing very delightful in the place; for the country is mountainous, and the soil dry. It abounds in hares, quails, turtle, and excellent falcons. It is about 50 miles in circumference, and had formerly good towns; but there is now none remaining but that which gives name to the island. This is strong both by art and nature, it being seated on a craggy rock. The inhabitants are Christian Greeks, and subject to the Venetians, who keep a governor there, whom they change every two years.

CERINES, a town in the island in Cyprus, with a good castle, an harbour, and a bishop's see. E. Long. 33. 35. N. Lat. 35. 22.

CERINTHE, HONEYWORT: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 41st order, *Asperifoliæ*. The limb of the corolla is a ventricose tube with the throat pervious; and there are two bilocular seeds. There are three species, natives of Germany, Italy, and the Alps. They are low annual plants with purple, yellow, and red flowers, which may be propagated by seed sown in autumn, in a warm situation.

CERINTHIANS, ancient heretics, who denied the deity of Jesus Christ.—They took their name from Cerinthus, one of the first heresiarchs in the church, being cotemporary with St John. See CERINTHUS.

They believed that Jesus Christ was a mere man, born of Joseph and Mary; but that, in his baptism, a celestial virtue descended on him in form of a dove; by means whereof he was consecrated by the holy Spirit, and made Christ. It was by means of this celestial virtue, therefore, that he wrought so many miracles; which, as he received it from heaven, quitted him after his passion, and returned to the place whence it came; so that Jesus, whom they called a *pure man*, really died and rose again; but that Christ, who was distinguished from Jesus, did not suffer at all. It was partly to refute this sect, that St John wrote his gospel. They received the gospel of St Matthew, to countenance their doctrine of circumcision, from Christ's being circumcised; but they omitted the genealogy. They discarded the epistles of St Paul, because that apostle held circumcision abolished.

CERINTHUS, a heresiarch, cotemporary with the apostles,

apostles, ascribed the creation not to God, but to angels. He taught that Jesus Christ was the son of Joseph, and that circumcision ought to be retained under the gospel. He is looked upon as the head of the converted Jews, who raised in the church of Antioch the tumult of which St Luke has given the history in the 15th chapter of the Acts. Some authors ascribe the book of the apocalypse to Cerinthus; adding, that he put it off under the name of St John, the better to authorise his reveries touching Christ's reign upon earth: and it is even certain that he published some works of this kind under the title of *Apocalypse*. See APOCALYPSE.

CEROPEGIA, in botany: a genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 30th order, *Contortæ*. There are two erect follicles; the seeds plumose or covered with a feathered pappus; the limb of the corolla connivent or closing at top.

Plate CXXV. CERTHIA, in orinthology, the CREEPER or OX-EYE, a genus belonging to the order of picæ. The beak is arched, slender, sharp, and triangular; the tongue is sharp at the point; and the feet are of the walking kind, *i. e.* having the toes open and unconnected. Of this genus near 50 species have been enumerated by ornithologists; but Mr Latham supposes that many now described as species, will be found hereafter to be mere varieties; which, he adds, is no wonder, since many creepers do not gain their full plumage till the third year's moult. The following are a few of the most remarkable:

1. The familiaris, or common ox-eye, is grey above, and white underneath, with brown wings, and ten white spots on the ten prime feathers. This bird is found in most parts of Europe, though it is believed no where so common as in Britain. It may be thought more scarce than it really is by the less attentive observer; for, supposing it on the body or branch of any tree, the moment it observes any one, it gets to the opposite side, and so on, let a person walk round the tree ever so often. The facility of its running on the bark of a tree, in all directions, is wonderful: This it does with as much ease as a fly on a glass window. Its food is principally, if not wholly, insects, which it finds in the chinks and among the moss of trees. It builds its nest in some hole of a tree, and lays generally five eggs, very rarely more than seven: these are ash-coloured, marked at the end with spots and streaks of a deeper colour; and the shell is observed to be pretty hard. It remains in the places which it frequents during the winter, and builds its nest early in the spring.

2. The hook-billed green creeper has a bill an inch and three quarters long, and bent quite in the shape of a semicircle; the plumage in general is olive green, palest beneath, and somewhat inclined to yellow: the quills and tail are dusky; the legs dusky brown; and the feathers just above the knee, or garter, white. It inhabits the Sandwich Islands in general, and is one of the birds whose plumage the natives make use of in constructing their feathered garments; which, having these olive-green feathers intermixed with the beautiful scarlet and yellow ones belonging to the next species, and yellow-tufted Bee-eater*, make some of the most beautiful coverings of these islanders.

* See Merops.

3. The hook-billed red creeper has the bill somewhat less hooked than the last species; the general colour of the plumage is scarlet; wings and tail black. In some birds the forehead is of a buff-colour; and the parts about the head and neck have both a mixture of buff and dusky black, which are suspected to be the birds not yet arrived at their full plumage.

4. The pusilla, or brown and white creeper, according to Edwards, is not above half the size of the European creeper. The upper part of the body is brown, with a changeable gloss of copper: the under parts are white; the quills brown, edged with glossy copper; the tail blackish, the outer feather tipped with white. The bird from which Edwards drew his figure had a label tied to it, by the name of Honey-thief. And that they are fond of honey is manifest, from those who keep birds at the Cape of Good Hope having many sorts in large cages, and supplying them with only honey and water; but besides this, they catch a great many flies, which come within the reach of their confinement; and these two make up their whole subsistence; indeed, it has been attempted to transport them further, but the want of flies on board a ship prevented them living more than three weeks; so necessary are insects to their subsistence.

5. The Loteni, or Loten's creeper, has the head, neck, back, rump, scapulars, and upper tail-coverts, of green gold: beneath, from the breast to the vent, of velvet black, which is separated from the green on the neck by a transverse bright violet band, a line and half in breadth: the lesser wing coverts are of this last colour; the middle coverts are green gold; and the greater coverts are very fine black, edged with green gold on the outer edge: the quills are of the same colour, as are also the tail feathers. The female differs in having the breast, belly, sides, thighs, under wing and tail coverts, of a dirty white, spotted with black; and the wings and tail not of so fine a black. It inhabits Ceylon, and Madagascar; and is called Angaladian.

Buffon tells us, that it makes its nest of the down of plants, in form of a cup, like that of a chaffinch, the female laying generally five or six eggs; and that it is sometimes chased by a spider as large as itself, and very voracious, which seizes on the whole brood, and sucks the blood of the young birds.

6. The cœrulea, or blue creeper, has the head of a most elegant blue; but on each side there is a stripe of black like velvet, in which the eye is placed: the chin and throat are marked with black in the same manner; the rest of the body violet blue. It inhabits Cayenne. Seba says, that it makes its nest with great art. The outside is composed of dry stalks of grass, or such like; but within of very downy soft materials, in the shape of a retort, which it suspends from some weak twig, at the end of a branch of a tree; the opening or mouth downwards, facing the ground: the neck is a foot in length, but the real nest is quite at the top, so that the bird has to climb up this funnel-like opening to get at the nest. Thus it is secure from every harm; neither monkey, snake, nor lizard, daring to venture at the end of the branch, as it would not steadily support them.

7. The cardinal creeper, (*Lev. Mus.*) has the head, neck, and breast, of crimson colour; down the middle

of the back is a ſtripe of the ſame colour to the rump; the reſt of the body is black; and the wings and tail are black. It inhabits the cultivated parts of the iſland of Tanna; is there called Kuyameta, and lives by ſucking the nectar of flowers.

8. The mocking creeper is of the ſize of the leſſer thruſh. On the cheeks is a narrow white ſpot: the head, eſpecially on the crown, is inclined to violet: the plumage in general is olive green, inclining to yellow on the under parts: the quills are brown; the ſecondaries edged with olive: the colour of the tail is like that of the ſecondaries, and ſomewhat forked: the legs are duſky blue, and the claws black. It inhabits both the iſlands of New Zealand. It has an agreeable note in general; but at times ſo varies and modulates the voice, that it ſeems to imitate the notes of all other birds; hence it was called by the Engliſh the Mocking-bird. This bird being fond of thruſting its head in the the boſom of flowers which have a purpliſh-coloured farina, much of it adheres to the feathers about the head and bill, and in courſe gives the appearance abovementioned; but this in time rubs off, and the colour of the head appears the ſame with the reſt of the plumage.

CERTIFICATE, *(Trial by)* in the law of England, a ſpecies of trial allowed in ſuch caſes where the evidence of the perſon certifying is the only proper criterion of the point in diſpute*. For when the fact in queſtion lies out of the cognizance of the court, the judges muſt rely on the ſolemn averment or information of perſons in ſuch a ſtation as affords them the moſt clear and competent knowledge of the truth. As therefore ſuch evidence, if given to a jury, muſt have been concluſive, the law, to ſave trouble and circuity, permits the fact to be determined upon ſuch certificate merely. Thus, 1. If the iſſue be whether A was abſent with the king in his army out of the realm in time of war, this ſhall be tried by the certificate of the mareſchal of the king's hoſt in writing under his ſeal, which ſhall be ſent to the juſtices. 2. If, in order to avoid an outlawry, or the like, it was alledged that the defendant was in priſon, *ultra mare*, at Bourdeaux, or in the ſervice of the mayor of Bourdeaux, this ſhould have been tried by the certificate of the mayor; and the like of the captain of Calais. But when this was law, thoſe towns were under the dominion of the crown of England. And therefore, by a parity of reaſon, it ſhould now hold, that in ſimilar caſes ariſing at Jamaica or Minorca, the trial ſhould be by certificate from the governor of thoſe iſlands. We alſo find that the certificate of the queen's meſſenger, ſent to ſummon home a peereſs of the realm, was formerly held a ſufficient trial of the contempt in refuſing to obey ſuch ſummons. 3. For matters within the realm; the cuſtoms of the city of London ſhall be tried by the certificate of the mayor and aldermen, certified by the mouth of their recorder; upon a ſurmiſe from the party alleging it, that the cuſtom ought to be thus tried: elſe it muſt be tried by the country. As, the cuſtom of diſtributing the effects of freemen deceaſed; of enrolling apprentices; or that he who is free of one trade may uſe another; if any of theſe, or other ſimilar points come in iſſue. 4. The trial of all cuſtoms and practiſe of the courts ſhall be by certificate from the proper officers of thoſe courts reſpectively; and what return was made on a writ by the ſheriff or under-ſheriff, ſhall be only tried by his own certificate.

*See *Trial*.

*Blackſtone's Comment.*



CERTIORARI, in law, a writ which iſſues out of the chancery, directed to an inferior court, to call up the records of a cauſe there depending, in order that juſtice may be done. And this writ is obtained upon complaint, that the party who ſeeks it has received hard uſage, or is not like to have an impartial trial in the inferior court. A certiorari is made returnable either in the king's bench, common pleas, or in chancery.

It is not only iſſued out of the court of chancery, but likewiſe out of the king's bench, in which laſt mentioned court it lies where the king would be certified of a record. Indictments from inferior courts, and proceedings of the quarter-ſeſſions of the peace, may alſo be removed into the king's bench by a certiorari: and here the very record muſt be returned, and not a tranſcript of it; though uſually in chancery, if a certiorari be returnable there, it removes only the tenor of the record.

CERTITUDE, conſidered in the things or ideas which are the objects of our underſtanding, is a neceſſary agreement or diſagreement of one part of our knowledge with another: as applied to the mind, it is the perception of ſuch agreement or diſagreement; or ſuch a firm well-grounded aſſent, as excludes not only all manner of doubt, but all conceivable poſſibility of a miſtake.

There are three ſorts of certitude, or aſſurance, according to the different natures and circumſtances of things. 1. A phyſical or natural certitude, which depends upon the evidence of ſenſe; as that I ſee ſuch or ſuch a colour, or hear ſuch or ſuch a ſound; no body queſtions the truth of this, where the organs, the medium, and the object, are rightly diſpoſed. 2. Mathematical certitude is that ariſing from mathematical evidence; ſuch is, that the three angles of a triangle are equal to two right ones. 3. Moral certitude is that founded on moral evidence, and is frequently equivalent to a mathematical one; as that there was formerly ſuch an emperor as Julius Cæſar, and that he wrote the commentaries which paſs under his name; becauſe the hiſtorians of theſe times have recorded it, and no man has ever diſproved it ſince: this affords a moral certitude, in common ſenſe ſo great, that one would be thought a fool or a madman for denying it.

CERTOSA, a celebrated Carthuſian monaſtery, in the territory of the Paveſe, in the duchy of Milan, four miles from Pavia; its park is ſurrounded with a wall 20 miles in circumference; but there are ſeveral ſmall towns and villages therein.

CERVANTES. See SAAVEDRA.

CERVERA, a town of Spain, in Catalonia, ſeated on a ſmall river of the ſame name, in E. Long. 1. 9. N. Lat. 41. 28.

CERVIA, a ſea-port town of Italy, in Romagna, with a biſhop's ſee, ſeated on the gulph of Venice, in E. Long. 13. 5. N. Lat. 44. 16.

CERVICAL NERVES, are ſeven pair of nerves, ſo called, as having their origin in the *cervix*.

*Cervical Veſſels*, among anatomiſts, denote the arteries, veins, &c. which paſs through the *vertebræ* and muſcles of the neck, up to the ſkull.

CERVIX, in anatomy, properly denotes the hind part of the neck; as contradistinguished from the fore part, which is called *jugulum*, or the throat.

*Cervix* of the *Scapula*, denotes the head of the shoulder-blade, or that upper process whose *sinus* receives the head of the *humerus*.

*Cervix* of the *Uterus*, the neck of the *uterus*, or that oblong canal, or passage between the internal and external orifices, which receives and incloses the *penis* like a sheath, whence it is also called VAGINA.

CERUMEN, a thick, viscous, bitter, excrementitious humour, separated from the blood by proper glands placed in the *meatus auditorius*, or outer passage of the ear.

CERUSS, WHITE-LEAD, a sort of calx of lead, made by exposing plates of that metal to the vapour of vinegar. See CHEMISTRY-*Index*.

Ceruss, as a medicine, is used externally either mixed in ointments, or by sprinkling it on old gleeting and watery ulcers, and in many diseases of the skin. If, when it is reduced into a fine powder, it is received in with the breath in inspiration, and carried down into the lungs, it causes incurable asthmas. Instances of the very pernicious effects of this metal are too often seen among those persons who work lead in any form, but particularly among the workers in white-lead.

The painters use it in great quantities; and that it may be afforded cheap to them, it is generally adulterated with common whiting.

Plate CXXIX, CXXX, and CXXXI.

CERVUS, or DEER, in zoology, a genus of quadrupeds belonging to the order of Pecora. The horns are solid, brittle, covered with a hairy skin, and growing from the top; they likewise fall off and are renewed annually. There are eight fore-teeth in the under jaw, and they have no dog-teeth. The species of this genus enumerated by Linnæus are seven, *viz.*

1. The Camelopardalis, or Giraffe, with simple or unbranched horns, straight, about six inches long, covered with hair, and truncated at the end and tufted; in the forehead a tubercle, about two inches high, resembling a third horn. The fore legs are not much longer than the hind legs; but the shoulders are of a vast length, which gives the disproportionate height between the fore and hind parts: the head is like that of a stag; the neck is slender and elegant, and on the upper side is a short mane: the ears are large: tail is long, with strong hairs at the end: the colour of the whole animal a dirty white, marked with large broad rusty spots. This is an uncommon animal, few of them having been ever seen in Europe. It inhabits the forests of Ethiopia, and other interior parts of Africa, almost as high as Senegal; but is not found in Guinea, or any of the western parts; nor farther south than about lat. 28. 10. It is very timid, but not swift; and has been represented as living only by browsing the trees, being unable from the disproportionate length of its fore legs to graze or feed from the ground. When it would leap, it lifts up its fore legs and then its hind, like a horse whose fore legs are tied. It runs very badly and aukwardly, and is very easily taken. The latest and best description of this extraordinary quadruped is given in the 16th number of a work entitled, "A Description of the uncommon Animals and remarkable Productions in the Cabinet and *Menagerie* of his Serene Highness the Prince of Orange;" by M. Vosmaer, Director of his Highness's Collections of Natural History. His account of the giraffe is composed partly from the notices of M. Vaillant and Mr Gordon of the Cape of Good Hope, and partly from his own observations on the skins of four of these animals, together with a complete skeleton, in the cabinet of curiosities under his care.



All the accounts we have of the giraffe, agree in representing its hind quarters as about $2\frac{1}{2}$ feet lower than its withers: but from observations made by the late professor Camper on the abovementioned skeleton, it would appear that naturalists have been greatly mistaken in this particular. That its fore legs are longer than its hind legs, is indeed true; but the difference is not more than seven inches, which, in a height of seven feet, is no great matter. It may, however (the professor observes), be rendered apparently more considerable by the obliquity of the thigh-bone with respect to the tibia, when compared with that of the humerus to the radius.

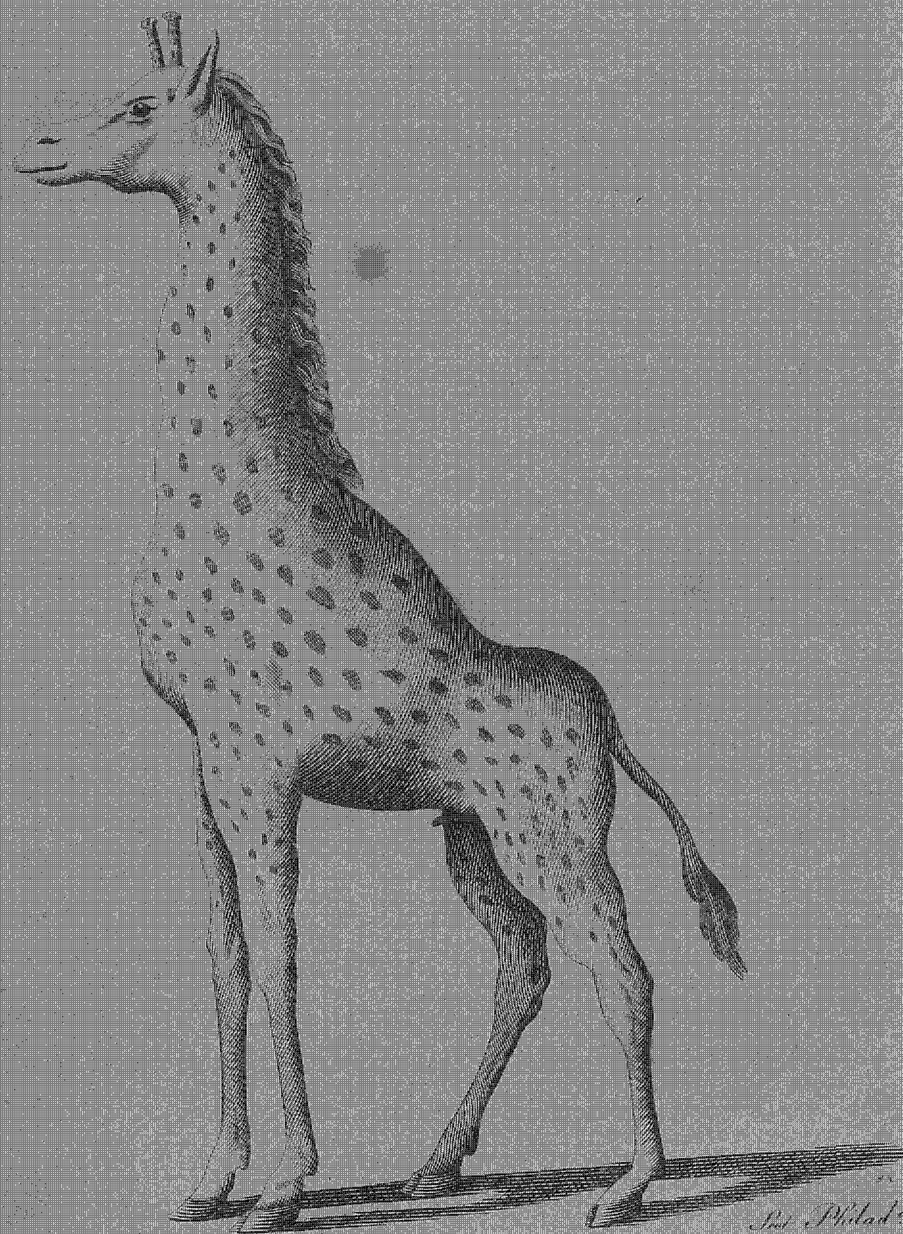
The giraffe has always been celebrated for the gentleness of its disposition. Antonius Constantius, a writer of the 15th century, in a letter to Galeas Manfredi, Prince of Faenza, dated Fano, 16th December 1486, gives an account of a giraffe which he saw there. He says it was so gentle, that it would eat bread, hay, or fruit, out of the hand of a child; and that, when led through the street, it would take whatever food of this kind was offered to it by the spectators at the windows, as it passed along. This character is confirmed by Mr Gordon, who relates, that a giraffe, which he had wounded, suffered him to approach it as it lay on the ground, without offering to strike with its horns, or showing any inclination to revenge itself: he even stroked it over its eyes several times, when it only closed them, without any signs of resentment. Its throat was afterwards cut for the sake of its skin; and when in the pangs of death, it struck the ground with its feet with a force much exceeding that of any other animal, and these seem to be its principal means of defence. M. Vosmaer observes, that both the male and female are furnished with horns, which, from their size and form, seem intended merely for ornament: they appear to be excrescences of the *os frontis*, and therefore are probably not deciduous. The notion of some writers, that the giraffe cannot feed from the ground, is confuted by the testimony of M. Vaillant, who asserts, that it can even drink from a river, the surface of which is lower than the bank on which it stands. M. Vosmaer observes, that this account is confirmed by considering the structure of the neck, the vertebræ of which are connected with those of the back by a very strong ligament.

The giraffe here described, which Mr Gordon, who dissected it, says was the largest he had ever seen, was 15 feet 4 inches Rhinland measure (about 15 feet 10 inches English) from the ground to the top of its head; the length of the body, from the chest to the rump, was 5 feet 7 inches Rhinland measure. M. Vaillant asserts, that he has seen several which were at least 17 feet high; and M. Vosmaer declares, that he has been assured by some very respectable inhabitants of the Cape, that they had seen and killed giraffes,

which,

Plate CXXIX

CERVUS
*Camelopardalis*



Cervus. which, including the horns, were 22 Rhinland feet in height.

The giraffe was known to the Romans in early times. It appears among the figures in the assemblage of eastern animals on the celebrated Prænestine Pavement, made by the direction of Sylla; and is represented both grazing and browsing, in its natural attitudes. It was exhibited at Rome by the popular Cæsar, among other animals in the Circæan games.

2. The Alces, Elk, or Moose Deer, has palmated horns, without any proper stem, and a fleshy protuberance on the throat. The neck is much shorter than the head, with a short, thick, upright mane, of a light brown colour. The eyes are small; the ears a foot long, very broad and slouching; nostrils very large; the upper lip square, hangs greatly over the lower, and has a deep sulcus in the middle, so as to appear almost bifid. This is the bulkiest animal of the deer kind, being sometimes 17 hands high, and weighing above 1200 pounds. The female is less than the male, and wants horns. The elks inhabit the isle of Cape Breton, Nova Scotia, and the western side of the bay of Fundy; Canada, and the country round the great lakes, almost as far south as the river Ohio. These are its present northern and southern limits. In all ages it affected the cold and woody regions in Europe, Asia, and America. They are found in all the woody tracts of the temperate parts of Russia, but not on the Arctic flats, nor yet in Kamtschatka. In Siberia they are of a monstrous size, particularly among the mountains. The elk and the moose, according to Mr Pennant, are the same species; the last derived from *musu*, which in the Algonkin language signifies that animal. The English used to call it the black moose, to distinguish it from the stag, which they named the grey moose. The French call it *l'orignal*.

These animals reside amidst forests, for the conveniency of browsing the boughs of trees, because they are prevented from grazing with any kind of ease, by reason of the shortness of their necks and length of their legs. They often have recourse to water-plants, which they can readily get at by wading. M. Sarrasin says, that they are very fond of the anagyris fœtida, or stinking bean trefoil, and will uncover the snow with their feet in order to get at it. In passing through the woods, they raise their heads to a horizontal position, to prevent their horns from being entangled in the branches. They have a singular gait: their pace is a shambling trot, but they go with great swiftness. In their common walk they lift their feet very high, and will without any difficulty step over a gate five feet high. They feed principally in the night. If they graze, it is always against an ascent; an advantage they use for the reason above assigned. They ruminate like the ox. They go to rut in autumn; are at that time very furious, seeking the female by swimming from isle to isle. They bring two young at a birth, in the month of April, which follow the dam a whole year. During the summer they keep in families. In deep snows they collect in numbers in the forests of pines, for protection from the inclemency of the weather under the shelter of those evergreens. They are very inoffensive, except in the rutting-season; or except they are wounded, when they will turn on the assailant, and attack him with their horns, or trample him to death beneath their great hoofs.

The flesh of the moose is extremely sweet and nourishing. The Indians say, that they can travel three times farther after a meal of moose, than after any other animal food. The tongues are excellent; but the nose is perfect marrow, and esteemed the greatest delicacy in Canada. The skin makes excellent buff; being strong, soft, and light. The Indians dress the hide, and, after soaking it for some time, stretch and render it supple by a lather of the brains in hot water. They not only make their snow-shoes of the skin, but after a chase form the canoes with it: they sew the skins neatly together, cover the seams with an unctuous earth, and embark in them with their spoils to return home. The hair on the neck, withers, and hams of a full-grown elk, is of much use in making mattresses and saddles; being by its great length well adapted for those purposes. The palmated parts of the horns are farther excavated by the savages, and converted into ladles, which will hold a pint.

It is not strange that so useful an animal should be a principal object of chase. The savages perform it in different ways. The first, and the more simple, is before the lakes or rivers are frozen. Multitudes assemble in their canoes, and form with them a vast crescent, each horn touching the shore. Another party perform their share of the chase among the woods; they surround an extensive tract, let loose their dogs, and press towards the water with loud cries. The animals, alarmed with the noise, fly before the hunters, and plunge into the lake, where they are killed by the persons in the canoes, prepared for their reception, with lances or clubs. The other method is more artful. The savages inclose a large space with stakes hedged with branches of trees, forming two sides of a triangle: the bottom opens into a second inclosure, completely triangular. At the opening are hung numbers of snares, made of slips of raw hides. The Indians, as before, assemble in great troops, and with all kinds of noises drive into the first inclosure not only the mooses, but the other species of deer which abound in that country: some, in forcing their way into the farthest triangle, are caught in the snares by the neck or horns; and those which escape the snares, and pass the little opening, find their fate from the arrows of the hunters, directed at them from all quarters. They are often killed with the gun. When they are first unharboured, they squat with their hind parts and make water, at which instant the sportsman fires; if he misses, the moose sets off in a most rapid trot, making, like the rein-deer, a prodigious rattling with its hoofs, and will run for 20 or 30 miles before it comes to bay or takes the water. But the usual time for their diversion is the winter. The hunters avoid entering on the chase till the sun is strong enough to melt the frozen crust with which the snow is covered, otherwise the animal can run over the firm surface: they wait till it becomes soft enough to impede the flight of the moose; which sinks up to the shoulders, flounders, and gets on with great difficulty. The sportsman pursues at his ease on his broad rackets, or snow-

 ſnow-ſhoes, and makes a ready prey of the diſtreſſed animals.

As weak againſt the mountain heaps they puſh
Their beating breaſt in vain, and piteous bray,
He lays them quivering on th' enſanguin'd ſnows,
And with loud ſhouts rejoicing bears them home.
THOMPSON.

The opinion of this animal's being ſubject to the epilepſy ſeems to have been univerſal, as well as the cure it finds by ſcratching its ear with the hind hoof till it draws blood. That hoof has been uſed in Indian medicine for the falling-ſickneſs; they apply it to the heart of the afflicted, make him hold it in his left hand, and rub his ear with it. They uſe it alſo in the colic, pleuriſy, vertigo, and purple fever; pulveriſing the hoof, and drinking it in water. The Algonkins pretend that the fleſh imparts the diſeaſe; but it is notorious that the hunters in a manner live on it with impunity. The ſavages eſteem the mooſe a beaſt of good omen; and are perſuaded that thoſe who dream often of it may flatter themſelves with long life.

The elk was known to the Romans by the name of *Alce* and *Machlis:* they believed that it had no joints in its legs; and, from the great ſize of the upper lip, imagined it could not feed without going backward as it grazed.

3. The Elaphus, or Stag, with long cylindrical ramified horns bent backwards, and ſlender ſharp brow antlers. The colour is generally a reddiſh brown with ſome black about the face, and a black liſt down the hind part of the neck and between the ſhoulders. Stags are common to Europe, Barbary, the north of Aſia, and America. In ſpring, they ſhed their horns, which fall off ſpontaneouſly, or by rubbing them gently againſt the branches of trees. It is ſeldom that both horns fall off at the ſame time, the one generally preceding the other a day or two. The old ſtags caſt their horns firſt, which happens about the end of February or beginning of March. An aged ſtag, or one in the ſeventh year or upwards, does not caſt his horns before the middle of March; a ſtag of ſix years ſheds his horns in April; young ſtags, or thoſe from three to five years old, ſhed their horns in the beginning, and thoſe which are in their ſecond year, not till the middle or end of May. But in all this there is much variety; for old ſtags ſometimes caſt their horns ſooner than thoſe which are younger. Beſides, the ſhedding of the horns is advanced by a mild, and retarded by a ſevere and long winter.

As ſoon as the ſtags caſt their horns, they ſeparate from each other, the young ones only keeping together. They no longer haunt the deepeſt receſſes of the foreſt, but advance into the cultivated country, and remain among bruſhwood during the ſummer, till their horns are renewed. In this ſeaſon, they walk with their heads low to prevent their horns from rubbing againſt the branches; for they continue to have ſenſibility till they acquire their full growth. The horns of the oldeſt ſtags are not half completed in the middle of May, and acquire their full length and hardneſs before the end of July. Thoſe of the younger ſtags are proportionally later both in ſhedding and being renewed. But as ſoon as they have acquired their full dimenſions and ſolidity, the ſtags rub them againſt the trees, in order to clear them of a ſkin with which they are covered. 

Soon after the ſtags have poliſhed their horns, they begin to feel the impreſſions of love. Towards the end of Auguſt or beginning of September, they leave the coppice, return to the foreſts, and ſearch for the hinds. They cry with a loud voice; their neck and throat ſwell; they become perfectly reſtleſs, and traverſe in open day the fields and the fallow grounds; they ſtrike their horns againſt trees and hedges; in a word, they ſeem to be tranſported with fury, and run from country to country till they find the hinds or females, whom they purſue and compel into compliance; for the female at firſt avoids and flies from the male, and never ſubmits to his embraces till ſhe be fatigued with the purſuit. The old hinds likewiſe come in ſeaſon before the younger ones. When two ſtags approach the ſame hind, they muſt fight before they enjoy. If nearly equal in ſtrength, they threaten, paw the ground, ſet up terrible cries, and attack each other with ſuch fury, that they often inflict mortal wounds with the ſtrokes of their horns. The combat never terminates but in the defeat or flight of one of the rivals. The conqueror loſes not a moment in enjoying his victory, unleſs another rival approaches, whom he is again obliged to attack and repel. The oldeſt ſtags are always maſters of the field; becauſe they are ſtronger and more furious than the young ones, who muſt wait patiently till their ſuperiors tire, and quit their miſtreſſes. Sometimes, however, the young ſtags accompliſh their purpoſes when the old ones are fighting, and, after a haſty gratification, fly off. The hinds prefer the old ſtags, not becauſe they are moſt courageous, but becauſe they are much more ardent. They are likewiſe more inconſtant, having often ſeveral females at a time; and when a ſtag has but one hind, his attachment to her does not continue above a few days: He then leaves her, goes in queſt of another, with whom he remains a ſtill ſhorter time; and in this manner paſſes from one to another till he is perfectly exhauſted.

This ardour of love laſts only three weeks, during which the ſtags take very little food, and neither ſleep nor reſt. Night and day, they are either walking, running, fighting, or enjoying the hinds. Hence, at the end of the rutting ſeaſon, they are ſo meagre and exhauſted, that they recover not their ſtrength for a conſiderable time. They generally retire to the borders of the foreſts, feed upon the cultivated fields, where they find plenty of nouriſhment, and remain there till their ſtrength is re-eſtabliſhed. The rutting ſeaſon of old ſtags commences about the beginning, and ends about the 20th day of September. In thoſe of ſix or ſeven years old, it begins about the 10th of September, and concludes in the beginning of October. In young ſtags, or thoſe in their third, fourth, or fifth year, it begins about the 20th of September, and terminates about the 15th of October; and at the end of October, the rutting is all over, excepting among the *prickets*, or thoſe which have entered into their ſecond year; becauſe they, like the young hinds, are lateſt of coming into ſeaſon. Hence, at the beginning of November, the ſeaſon of love is entirely finiſhed; and the ſtags, during this period of weakneſs and laſſitude, are eaſily hunted down. In ſeaſons when acorns

and

Cervus. and other nuts are plentiful, the ſtags ſoon recover their ſtrength, and a ſecond rutting frequently happens at the end of October; but it is of much ſhorter duration than the firſt.

In climates warmer than that of France, the rutting time, like the ſeaſons, is more forward. Ariſtotle informs us, that, in Greece, it commences in the beginning of Auguſt, and terminates about the end of September. The hinds go with young eight months and ſome days, and ſeldom produce more than one fawn. They bring forth in May or the beginning of June, and ſo anxiouſly conceal their fawns, that they often expoſe themſelves to be chaſed, with a view to draw off the dogs, and afterwards return to take care of their young. All hinds are not fertile; for ſome of them never conceive. Theſe barren hinds are groſſer and fatter than thoſe which are prolific, and alſo come ſooneſt in ſeaſon. The young are not called *fawns* or *calves* after the ſixth month: The (knobs of their horns then begin to appear, and they take the name of *knobbers* till their horns lengthen into *ſpears*, and then they are called *brocks* and *ſtaggards*. During the firſt ſeaſon they never leave their mothers. In winter, the ſtags and hinds of all ages, keep together in flocks, which are always more numerous in proportion to the rigour of the ſeaſon. They ſeparate in ſpring: The hinds retire to bring forth; and, during this period, the flocks conſiſt only of knobbers and young ſtags. In general, the ſtags are inclined to aſſociate, and nothing but fear or neceſſity obliges them to diſperſe.

The life of the ſtag is ſpent in alternate plenty and want, vigour and debility, health and ſickneſs, without having any change introduced into his conſtitution by theſe oppoſite extremes. He lives as long as other animals which are not ſubjected to ſuch viciſſitudes. As he grows five or ſix years, he lives ſeven times that number, or from 35 to 40 years. What has been reported concerning the longevity of the ſtag merits no credit. It is only a popular prejudice which prevailed in the days of Ariſtotle, and which that philoſopher conſidered as improbable, becauſe neither the time of geſtation nor of the growth of the young ſtag, indicated long life. This authority ought to have aboliſhed the prejudice; but it has been renewed, in the ages of ignorance, by a fabulous account of a ſtag taken by Charles VI. in the foreſt of Senlis, with a collar upon which was written this inſcription, *Cæſar hoc me donavit*. The love of the marvellous inclined men to believe that this animal had lived 1000 years, and had his collar from a Roman Emperor, rather than to ſuppoſe that he came from Germany, where all the emperors take the name of *Cæſar*.

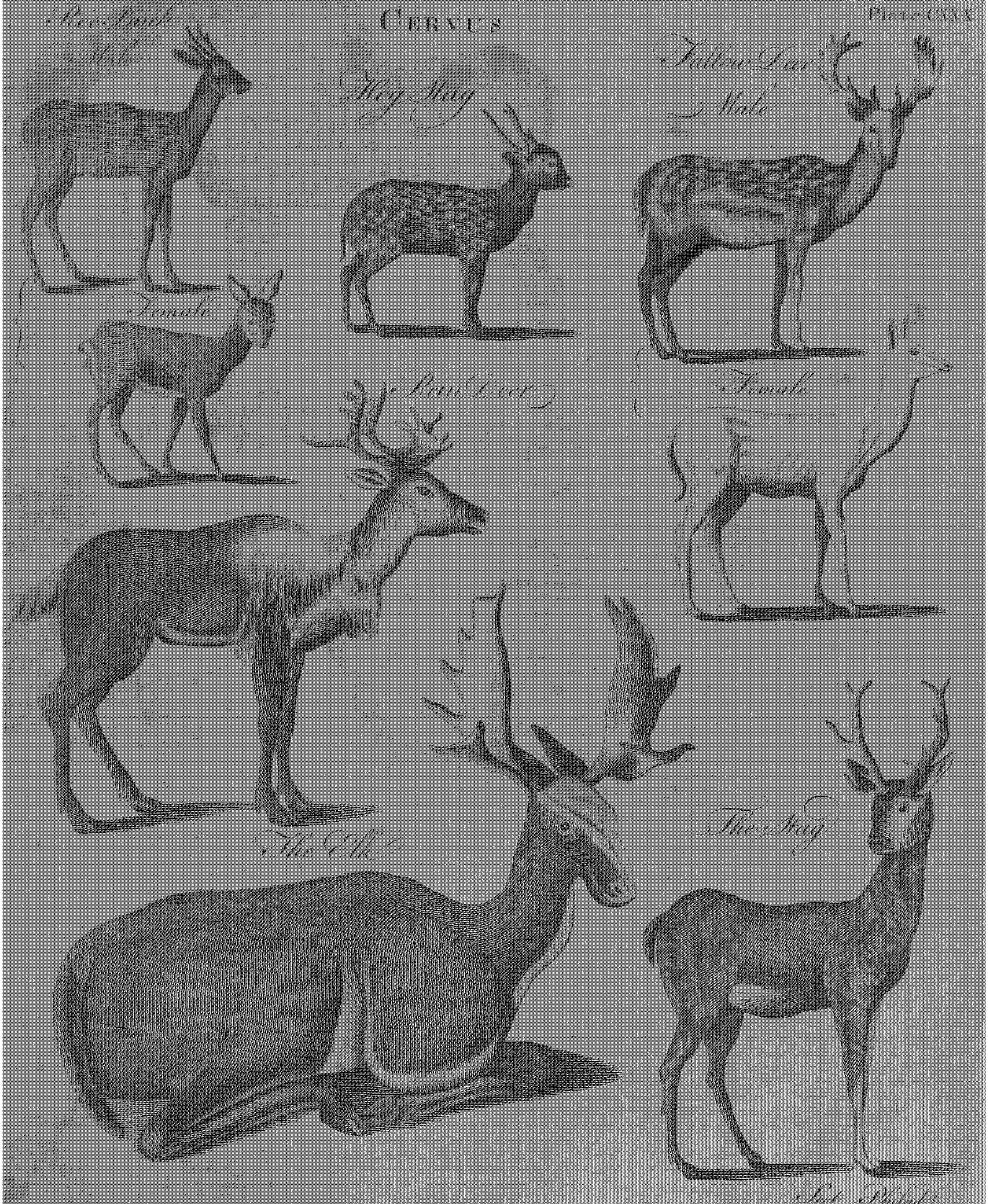
The ſtag appears to have a fine eye, an acute ſmell, and an excellent ear. When liſtening, he raiſes his head, erects his ears, and hears from a great diſtance. When he is going into a coppice, or other half covered place, he ſtops to look round him on all ſides, and ſcents the wind, to diſcover if any object is near that might diſturb him. He is a ſimple and yet a curious and crafty animal. When hiſſed or called to from a diſtance, he ſtops ſhort, and looks ſteadfaſtly, and with a kind of admiration at carriages, cattle, or men; and if they have neither arms nor dogs, he moves on unconcernedly, and without flying. He appears to liſten with great tranquillity and delight to the ſhepherd's pipe; and the hunters ſometimes employ this artifice to encourage and deceive him. In general, he is leſs afraid of men than of dogs, and is never ſuſpicious, or uſes any arts of concealment, but in proportion to the diſturbances he has received. He eats ſlow, and has a choice in his aliment; and after his ſtomach is full, he lies down, and ruminates at leiſure. He ſeems to ruminate with leſs facility than the ox. It is only by violent ſhakes that the ſtag can make the food riſe from his firſt ſtomach. This difficulty proceeds from the length and direction of the paſſage through which the aliment has to go. The neck of the ox is ſhort and ſtraight, but that of the ſtag is long and arched; and therefore greater efforts are neceſſary to raiſe the food. Theſe efforts are made by a kind of hiccup, the movement of which is apparent, and continues during the time of rumination. His voice is ſtronger and more quivering, in proportion as he advances in years. The voice of the hind is ſhorter and more feeble. She never bellows from love, but from fear. The ſtag during the rutting ſeaſon, bellows in a frightful manner: He is then ſo tranſported, that nothing diſturbs or terrifies him. He is therefore eaſily ſurpriſed; as he is loaded with fat, he cannot keep long before the dogs. But he is dangerous when at bay, and attacks the dogs with a ſpecies of fury. He drinks none in winter nor in ſpring, the dews and tender herbage being then ſufficient to extinguiſh his thirſt; but during the parching heats of ſummer, to obtain drink, he frequents the brooks, the marſhes, and the fountains; and in the ſeaſon of love, he is ſo over-heated, that he ſearches every where for water, not only to ſatiſfy his immoderate thirſt, but to bathe and refreſh his body. He then ſwims eaſier than at any other times on account of his fatneſs. He has been obſerved croſſing very large rivers. It has even been alleged, that, attracted by the odour of the hinds, the ſtags, in the rutting ſeaſon, throw themſelves into the ſea, and paſs from one iſland to another at the diſtance of ſeveral leagues. They leap ſtill more nimbly than they ſwim; for, when purſued, they eaſily clear a hedge or a pale fence of ſix feet high. Their food varies in different ſeaſons. In autumn, after rutting, they ſearch for the buds of green ſhrubs, the flowers of broom or heath, the leaves of brambles, &c. During the ſnows of winter, they feed upon the bark, moſs, &c. of trees; and in mild weather, they browſe in the wheat-fields. In the beginning of ſpring, they go in queſt of the catkins of the trembling popular, willow, and hazel-trees, the flowers and buds of the cornel tree, &c. In ſummer, when they have great choice, they prefer rye to all other grain, and the black berry-bearing alder to all other wood. The fleſh of the fawn is very good: that of the hind and knobber not abſolutely bad; but that of the ſtag has always a ſtrong and diſagreeable taſte. The ſkin and the horns are the moſt uſeful parts of this animal. The ſkin makes a pliable and very durable leather. The horns are uſed by cutlers, ſword-ſlippers, &c. and a volatile ſpirit, much employed in medicine, is extracted from them by the chymiſts.

In America, ſtags feed eagerly on the broad-leaved kalmia; yet that plant is a poiſon to all other horned animals: their inteſtines are found filled with it during winter. If their entrails are given to dogs, they become ſtupified, and as if drunk, and often are ſo ill as

Cervus. as hardly to escape with life. The American stags grow very fat: their tallow is much esteemed for making of candles. The Indians shoot them. As they are very shy animals, the natives cover themselves with a hide, leaving the horns erect; under the shelter of which they walk within the reach of the herd. De Brie, in the 25th plate of the History of Florida, gives a very curious representation of this artful method of chase, when it was visited by the French in 1564. Their skins are an article of commerce imported by the Hudson's Bay Company; but brought from the distant parts far inland by the Indians, who bring them from the neighbourhood of the lakes. In most parts of North America they are called the grey moose, and the elk; this has given occasion to the mistaken notion of that great animal being found in Virginia and other southern states.

In Britain the stag is become less common than formerly; its excessive viciousness during the rutting season, and the badness of its flesh, induce most people to part with the species. Stags are still found wild in the Highlands of Scotland, in herds of four or five hundred together, ranging at full liberty over the vast hills of the north. Formerly the great Highland chieftains used to hunt with the magnificence of an eastern monarch, assembling four or five thousand of their clan, who drove the deer into the toils, or to the stations the lairds had placed themselves in: but as this pretence was frequently used to collect their vassals for rebellious purposes, an act was passed prohibiting any assemblies of this nature. Stags are likewise met with on the moors that border on Cornwall and Devonshire; and in Ireland on the mountains of Kerry, where they add greatly to the magnificence of the romantic scenery of the lake of Killarney. The stags of Ireland during its uncultivated state, and while it remained an almost boundless tract of forest, had an exact agreement in habit with those that range at present through the wilds of America. They were less in body, but very fat; and their horns of a size far superior to those of Europe, but in form agreed in all points.

The chase of the stag has been formed into an art, and requires a species of knowledge which can only be learned by experience: It implies a royal assemblage of men, horses, and dogs, all so trained, practised, and disciplined, that their movements, their researches, and their skill, must concur in producing one common end. The huntsman should know the age and the sex of the animal; he should be able to distinguish with precision, whether the stag he has harboured with his hound be a knobber, a young stag, in his sixth or seventh year, or an old stag. The chief marks which convey this intelligence is derived from the foot, and the excrement. The foot of the stag is better formed than that of the hind, or female. Her leg is more gross and nearer the heel. The impressions of his feet are rounder, and farther removed from each other. He moves more regularly, and brings the hind-foot into the impression made by the fore-foot. But the distance between the steps of the hind are shorter, and her hind-feet strike not so regularly the track of the fore-feet. As soon as the stag acquires his fourth horns, he is easily distinguished; but to know the foot of a young stag from that of a hind, requires repeated experience. Stags of six, seven, &c. years, are still more easily known; for their fore-foot is much larger than the hind-foot; the older they are, the sides of their feet are the more worn; the distance of their steps are more regular than those of young stags; they always place their hind-foot exactly in the track of the fore-foot, excepting when they shed their horns, the old stags misplace at this season, nearly as often as the young ones, but in this they are more regular than the hind or young stag, placing the hind-foot always at the side of the fore-foot, and never beyond or within it. When the huntsman, from the dryness of the season, or other circumstances, cannot judge by the foot, he is obliged to trace the animal backwards, and endeavour to find his dung. This mark requires, perhaps, greater experience than the knowledge of the foot; but without it the huntsman would be unable to give a proper report to the company. After the report of the huntsman, and the dogs are led to the refuge of the stag, he ought to encourage his hound, and make him rest upon the track of the stag, till the animal be unharboured. Instantly the alarm is given to uncouple the dogs, which ought to be enlivened by the voice and the horn of the huntsman. He should also diligently observe the foot of the stag, in order to discover whether the animal has started, and substituted another in his place. But it is then the business of the hunters to separate also, and to recal the dogs which have gone astray after false game. The huntsman should always accompany his dogs, and encourage, without pressing them too hard. He should assist them in detecting all the arts of escape used by the stag; for this animal has remarkable address in deceiving the dogs. With this view he often returns twice or thrice upon his former steps; he endeavours to raise hinds or younger stags to accompany him, and draw off the dogs from the object of their pursuit: he then flies with redoubled speed, or springs off at side, lies down on his belly, and conceals himself. In this case, when the dogs have lost his foot, the huntsmen, by going backwards and forwards, assist them in recovering it. But if they cannot find it, they suppose that he is resting within the circuit they have made, and go in quest of him. But if they are still unable to discover him, there is no other method left, but, from viewing the country, to conjecture where he may have taken refuge, and repair to the place. As soon as they have recovered his foot, and put the dogs upon the track, they pursue with more advantage, because they perceive that the stag is fatigued. Their ardour augments in proportion to his feebleness; and their scent becomes more distinct as the animal grows warm. Hence they redouble their cries and their speed; and though the stag practises still more arts of escape than formerly, as his swiftness is diminished, his arts and doublings become gradually less effectual. He has now no other resource but to fly from the earth which he treads, and get into the waters, in order to cut off the scent from the dogs. The huntsmen go round these waters, and again put the dogs on the track of his foot. The stag, after taking to the water is incapable of running far, and is soon at bay. But he still attempts to defend his life, and often wounds the dogs, and even the huntsmen when too forward, by blows with his horns, till one of them cuts his hams Cervus.


CERVUS
Plate CXXX
Roe Buck
Male
Female
Hog Stag
Fallow Deer
Male
Female
Rein Deer
The Elk
The Stag
Scot Philad

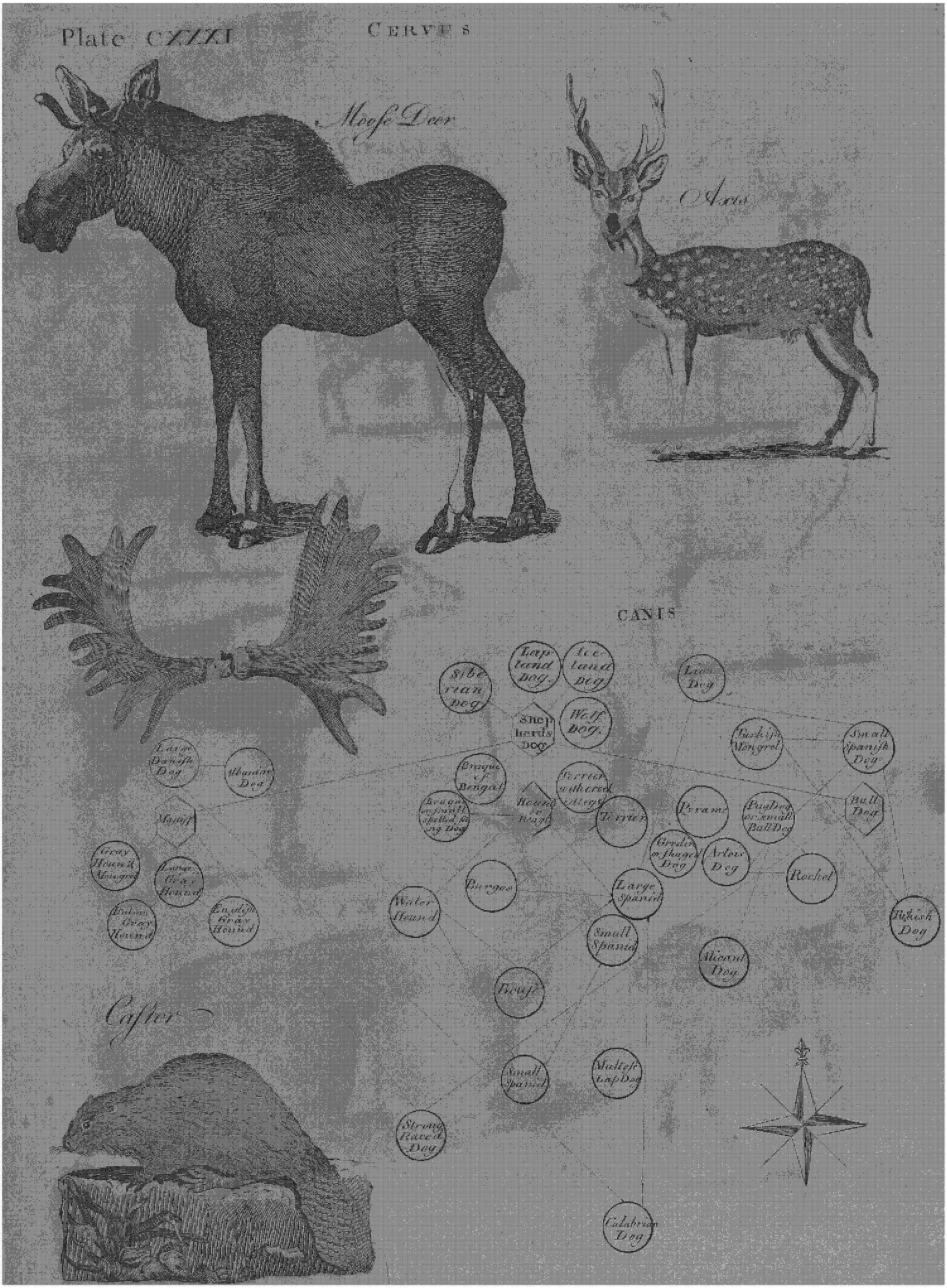


Plate CXXXI
CERVUS
Moose Deer
Axis
CANIS
Lapland Dog
Iceland Dog
Siberian Dog
Lion Dog
Shepherds Dog
Wolf Dog
Turkish Mongrel
Small Spanish Dog
Large Danish Dog
Braque of Bengal
Terrier with crooked Legs
Bull Dog
Mastiff
Hound or Beagle
Terrier
Pyrame
Pugdog or small Bull Dog
Gray Hound Mongrel
Large Gray Hound
Artois Dog
Rochet
Burgos
Large Spaniel
Water Hound
English Gray Hound
Small Spaniel
Alicant Dog
Bouse
Castor
Small Spaniel
Maltese Lap Dog
Strong Raced Dog
Calabrian Dog

Cervus.

hams to make him fall, and then puts an end to his life, by a blow of a hanger. They now celebrate the death of the stag by a flourish of their horns: the dogs are allowed to trample upon him, and at last partake richly of the victory by devouring his flesh.

4. The Tarandus, or Rein-deer, is a native of Lapland, and the northern parts of Europe, Asia, and America. The horns are large, cylindrical, branched, and palmated at the tops. Two of the branches hang over the face. He is about the size of a buck, of a dirty whitish colour; the hairs of his skin are thick and strong. To the Laplanders this animal is the substitute of the horse, the cow, the goat, and the sheep; and is their only wealth: the milk affords them cheese; the flesh, food; the skin, cloathing; the tendons, bow-strings; and when split, thread; the horns, glue; the bones, spoons. During the winter it supplies the want of a horse, and draws their sledges with amazing swiftness, over the frozen lakes and rivers, or over the snow, which at that time covers the whole country. A rich Laplander is possessed of a herd of 1000 rein deer. In autumn they seek the highest hills, to avoid the Lapland gad-fly, which at that time deposits its eggs in their skin; it is the pest of these animals, and numbers die that are thus visited. The moment a single fly appears, the whole herd instantly perceives it; they fling up their heads, toss about their horns, and at once attempt to fly for shelter amidst the snows of the loftiest Alps. In summer they feed on several plants; but during winter on the rein-liverwort, which lies far beneath the snow, which they remove with their feet and palmated brow antlers, in order to get at their beloved food.

The Samoieds, less intelligent than the Laplanders, consider them in no other view than as animals of draught, to convey them to the chase of the wild reins; which they kill for the sake of the skins, either to clothe themselves, or to cover their tents. They know not the cleanly delicacy of the milk or cheese; but prefer for their repast the intestines of beasts, or the half-putrid flesh of a horse, ox, or sheep, which they find dead on the high road.—The Koreki, a nation of Kamtschatka, may be placed on a level with the Samoieds. They keep immense herds of reins; some of the richest to the amount of 10 or 20 thousand; yet so sordid are they as to eat none except such as they kill for the sake of the skins; an article of commerce with their neighbours the Kamtschatkans; otherwise they content themselves with the flesh of those which die by disease or chance. They train them in the sledge, but neglect them for every domestic purpose. Their historian says, they couple two to each carriage; and that the deer will travel 150 versts in a day, that is 112 English miles. They castrate the males by piercing the spermatic arteries, and tying the scrotum tight with a thong.—The savage and uninformed Eskimaux and Greenlanders, who possess, amidst their snows, these beautiful animals, neglect not only the domestic uses, but even are ignorant of their advantage in the sledge. Their element is properly the water; their game the seals. They seem to want powers to domesticate any animals except dogs. They are at enmity with all; consider them as an object of chase, and of no utility till deprived of life. The flesh of the rein is the most coveted part of their food; they eat it raw, dressed, and dried and smoked with the snow lichen. The wearied hunters will drink the raw blood; but it is usually dressed with the berries of the heath: they eagerly devour the contents of the stomach, but use the intestines boiled. They are very fond of the fat, and will not lose the least bit. The skin, sometimes a part of their cloathing, dressed with the hair on, is soft and pliant; it forms also the inner lining of their tents, and most excellent blankets. The tendons are their bow-strings, and when split are the threads with which they sew their jackets.

Cervus.

The Greenlanders, before they acquired the knowledge of the gun, caught them by what was called the *clapper-hunt*. The women and children surrounded a large space, and, where people were wanting, set up poles capped with a turf in certain intervals, to terrify the animals; they then with great noise drove the reins into the narrow defiles, where the men lay in wait and killed them with harpoons or darts. But they are now become very scarce.

The rein-deers are found in the neighbourhood of Hudson's Bay, in most amazing numbers, columns of eight or ten thousand are seen annually passing from north to south in the months of March and April, driven out of the woods by the musketoes, seeking refreshment on the shore, and a quiet place to drop their young. They go to rut in September, and the males soon after shed their horns; they are at that season very fat, but so rank and musky as not to be eatable. The females drop their young in June, in the most sequestered spots they can find; and then they likewise lose their horns. Beasts of prey follow the herds: first, the wolves, who single out the stragglers (for they fear to attack the drove), detach and hunt them down: the foxes attend at a distance, to pick up the offals left by the former. In autumn the deer with the fawns remigrate northward. The Indians are very attentive to their motions; for the rein forms the chief part not only of their dress but of their food. They often kill multitudes for the sake of their tongues only; but generally they separate the flesh from the bones, and preserve it by drying it in the smoke; they also save the fat, and sell it to the English in bladders, who use it in frying instead of butter. The skins are also an article of commerce, and used in London by the breeches-makers. The Indians shoot them in the winter. The English make hedges with stakes and boughs of trees along the woods for five miles in length, leaving openings at proper intervals beset with snares, in which multitudes are taken. The Indians also kill great numbers during the seasons of migration, watching in their canoes, and spearing them while passing over the rivers of the country, or from island to island; for they swim most admirably well.

5. The Dama or Fallow-deer, Buck and Doe; with horns branched, compressed, and palmated at the top. The colour is various; reddish, deep brown, white or spotted. This species is not so universal as the stag: rare in France and Germany. It is found in Greece, the Holy Land, and the north of China. They are very numerous in England; but, except on a few chases, confined in parks. None originally in America. They are easily tamed; and their flesh, which goes by the name of venison, is in high esteem among the luxurious. During rutting-time they will contend

with each other for their mistress, but are less fierce than the stag; during that season, the male will form a hole in the ground, make the female lie down in it, and then often walk round and smell at her. Moore speaks of a species found on the banks of the Gambia, in the interior parts of Africa, near Barracunda, called *Toncong*, which he says differed not in form from the English fallow-deer; only that its size was equal to that of a small horse, and weighed 300lb. It had also on its neck an erect black mane, four or five inches long.—Mr White, in his Natural History of Pelborn, mentions as a piece of information to naturalists, that if some curious gentleman would procure the head of a fallow-deer, and have it dissected, he would find it furnished with two *spiracula*, or breathing places, besides the nostrils; probably analogous to the *puncta lachrymalia* in the human head. When deer are thirsty they plunge their noses, like some horses, very deep under water, while in the act of drinking, and continue them in that situation for a considerable time; but, to obviate any inconveniency, they can open two vents, one at the inner corner of each eye, having a communication with the nose. This seems, as our author observes, to be an extraordinary provision of nature; for it looks as if these creatures could not be suffocated, though their mouths and nostrils were both stopped. This curious formation of the head, he farther remarks, may be of singular service to beasts of chase, by affording them free respiration; and no doubt these additional nostrils are thrown open when they are hard run. Mr Pennant has observed the same curious organization in the antelope. See Capra.

6. The Capreolus, or Roe-buck, has erect cylindrical, branched horns, and forked at the top. His size is only three feet nine inches long, two feet three inches high before, and two feet seven inches high behind: weight from 50 to 60lb. Though the least of the deer-kind, his figure is most elegant and handsome. His eyes are more brilliant and animated than those of the stag. His limbs are more nimble, his movements quicker, and he bounds, seemingly without effort, with equal vigour and agility. His coat, or hair, is always clean, smooth, and glossy. He never wallows in the mire like the stag. He delights in dry and elevated situations, where the air is purest. He is likewise more crafty, conceals himself with greater address, is more difficult to trace, and derives superior resources from instinct; for though he has the misfortune to leave behind him a stronger scent than the stag, which redoubles the ardour and appetite of the dogs, he knows how to withdraw himself from their pursuit, by the rapidity with which he begins his flight, and by his numerous doublings. He delays not his arts of defence till his strength fails him; but, as soon as he finds that the first efforts of a rapid chase have been unsuccessful, he repeatedly returns on his former steps; and after confounding by these opposite movements, the direction he has taken, after intermixing the present with the past emanations from his body, he rises from the earth with a great bound, and retiring to a side, he lies down flat on his belly; and in this immoveable situation, he allows the whole troop of his deceived enemies to pass very near him.

The roe-deer differs from the stag and fallow-deer in disposition, temperament, manners, and almost every natural habit. Instead of associating in herds, they live in separate families. The father, mother, and young, go together, and never mix with strangers. They are constant in their amours, and never unfaithful like the stag. As the females generally produce two fawns, the one male and the other female, these young animals, brought up and nourished together, acquire so strong a mutual affection, that they never quit each other, unless one of them meets with a misfortune, which never ought to separate lovers. This attachment is more than love; for though always together, they feel the ardour of the rut but once a year, and it continues only fifteen days, commencing at the end of October, and ending before the fifteenth day of November. They are not then, like the stag, overloaded with fat: they have no strong smell, no fury, in a word, nothing that can change the state of their bodies. During this period, they indeed suffer not their fawns to remain with them. The father drives them off, as if he meant to oblige them to yield their place to those which are to succeed, and to form new families for themselves. However, after the rutting season is past, the fawns return to their mother, and remain with her some time; after which they separate for ever, and remove to a distance from the place which gave them birth.

The female goes with young five months and a half, and brings forth about the end of April or beginning of May. She produces two at a time, which she is obliged to conceal from the buck while very young. In 10 or 12 days they acquire strength sufficient to enable them to follow her. When threatened with danger, she hides them in a close thicket, and, to preserve them presents herself to be chased. But notwithstanding all her care and anxiety, the young are sometimes carried off by men, dogs, or wolves.

Roe-bucks prefer a mountainous woody country to a plain one. They were formerly very common in Wales, in the north of England, and in Scotland; but at present the species nowhere exists in Great-Britain, except in the Scottish highlands. In France they are more frequent; they are also found in Italy, Sweden, and Norway; and in Asia they are met with in Siberia. The first that are met with in Great-Britain, are in the woods on the south side of Loch-Rannoch, in Perthshire: the last in those of Longwal, on the southern borders of Caithness; but they are most numerous in the beautiful forests of Invercauld, in the midst of the Grampian hills. They are unknown in Ireland. Wild roes, during summer, feed on grass; and are very fond of the *rubus saxatilis*, called in the Highlands the roe-buck berry; but in the winter time, when the ground is covered with snow, they brouse on the tender branches of the fir and birch.

7. The Guineensis, about the size of a cat, is of a greyish colour, and black underneath. It is a native of Guinea, and the size and figure of its horns have not been hitherto described with any precision.

8. The Axis, or Speckled Deer, has slender trifurcated horns; the first branch near the base, the second near the top, each pointing upwards. This species is about the size of the fallow-deer; of a light red colour; the body beautifully marked with white spots;

Cervus.

along the lower part of the ſides, next the belly, is a line of white; the tail long, as that of a fallow-deer; red above, white beneath.—They are common on the banks of the Ganges, and in the iſle of Ceylon. Pliny deſcribes them well among the animals of India, and adds that they were ſacred to Bacchus. They will bear other climates; and have bred in the prince of Orange's menagery near the Hague. They are very tame, and have the ſenſe of ſmelling in an exquiſite degree. They readily eat bread, but will refuſe a piece that has been breathed on: many other animals of this, the antelope and goat kind, will do the ſame.

9. The Porcine or Hog-Deer, has ſlender trifurcated horns, 13 inches long: His body is thick and clumſy; his legs are fine and ſlender: The upper part of the neck, body, and ſides, are brown; belly and rump of a lighter colour.—They are found in Bengal; and called, from the thickneſs of their body, *hog-deer*. The ſame ſpecies is alſo found in Borneo. They are taken in ſquare pit-falls, about four feet deep, covered with ſome ſlight materials. Of their feet, as well as thoſe of the leſſer ſpecies of muſks and antelopes, are made tobacco-ſtoppers.

10. The Virginiana, or Virginian Deer, has ſlender horns bending very much forward; numerous branches on the interior ſides; no brow antlers. It is about the ſize of the Engliſh fallow-deer; of a light colour, cinereous brown. A quite diſtinct ſpecies, and peculiar to America. It inhabits all the provinces ſouth of Canada, but in the greateſt abundance in the ſouthern; but eſpecially the vaſt ſavannas contiguous to the Miſſiſippi, and the great rivers which flow into it. They graze in herds innumerable, along with the ſtags and buffaloes. This ſpecies probably extends to Guiana, and is the *baieu* of that country, which is ſaid to be about the ſize of a European buck, with ſhort horns, bending at their ends. They are capable of being made tame; and when properly trained, are uſed by the Indians to decoy the wild deer (eſpecially in the rutting ſeaſon) within ſhot. Both bucks and does herd from September to March; after that they ſeparate, and the does ſecret themſelves to bring forth, and are found with difficulty. The bucks from this time keep ſeparate till the amorous ſeaſon of September revolves. The deer begin to feed as ſoon as night begins; and ſometimes in the rainy ſeaſon, in the day; otherwiſe they ſeldom or never quit their haunts. An old American ſportſman has remarked that the bucks will keep in the thickets for a year, or even two.

Theſe animals are very reſtleſs, and always in motion, coming and going continually. Thoſe which live near the ſhore are lean and bad, ſubject to worms in their heads and throats, generated from the eggs depoſited in thoſe parts. Thoſe that frequent the hills and ſavannas are in better caſe, but the veniſon is dry. In hard winters they will feed on the long moſs which hangs from the trees in the northern parts.

Theſe and other cloven-footed quadrupeds of America are very fond of ſalt, and reſort eagerly to the places impregnated with it. They are always ſeen in great numbers in the ſpots where the ground has been torn by torrents or other accidents, where they are ſeen licking the earth. Such ſpots are called *licking-places*. The huntſmen are ſure of finding the game there; for notwithſtanding they are often diſturbed, the buffaloes and deer are ſo paſſionately fond of the ſavoury regale, as to bid defiance to all danger, and return in droves to theſe favourite haunts.

The deer are of the firſt importance to the ſavages. The ſkins form the greateſt branch of their traffic, by which they procure from the coloniſts, by way of exchange, many of the articles of life. To all of them the fleſh is the principal food throughout the year; for drying it over a gentle but clear fire, after cutting it into ſmall pieces, it is not only capable of long preſervation, but is very portable in their ſudden excurſions, eſpecially when reduced to powder, which is frequently done.

Hunting is more than an amuſement to theſe people. They give themſelves up to it not only for the ſake of ſubſiſtence, but to fit themſelves for war, by habituating themſelves to fatigue. A good huntſman is an able warrior. Thoſe who fail in the ſports of the field are never ſuppoſed to be capable of ſupporting the hardſhips of a campaign; they are degraded to ignoble offices, ſuch as dreſſing the ſkins of deer, and other employs allotted only to ſlaves and women. When a large party meditates a hunting-match, which is uſually at the beginning of winter, they agree on a place of rendezvous, often 500 miles diſtant from their homes, and a place perhaps that many of them had never been at. They have no other method of fixing on the ſpot than by pointing with their finger. The preference is given to the eldeſt, as the moſt experienced. When this matter is ſettled, they ſeparate into ſmall parties, travel and hunt for ſubſiſtence all the day, and reſt at night; but the women have no certain reſting-places. The ſavages have their particular hunting countries; but if they invade the limits of thoſe belonging to other nations, feuds enſue, fatal as thoſe between Percy and Douglas in the famed Chevy Chace. As ſoon as they arrive on the borders of the hunting country (which they never fail doing to a man, be their reſpective routes every ſo diſtant or ſo various), the captain of the band delineates on the bark of a tree his own figure with a rattleſnake twined round him with diſtended mouth; and in his hand a bloody tomahawk. By this he implies a deſtructive menace to any who are bold enough to invade their territories, or to interrupt their diverſion.—The chaſe is carried on in different ways. Some ſurpriſe the deer by uſing the ſtale of the head, horns, and hide; but the general method is performed by the whole body. Several hundreds diſperſe in a line, encompaſſing a vaſt ſpace of country, fire the woods, and drive the animals into ſome ſtrait or peninſula, where they become an eaſy prey. The deer alone are not the object; foxes, raccoons, bears, and all beaſts of fur, are thought worthy of attention, and form articles of commerce with the Europeans.

The number of deer deſtroyed in ſome parts of America is incredible; as is pretended, from an abſurd idea which the ſavages have, that the more they deſtoy, the more they ſhall find in ſucceeding years. Certain it is that multitudes are deſtroyed; the tongues only preſerved, and the carcaſes left a prey to wild beaſts. But the motive is much more political. The savages well discern, that should they overstock the market, they would certainly be over-reached by the European dealers, who take care never to produce more goods than are barely sufficient for the demand of the season, establishing their prices according to the quantity of furs brought by the natives.

*Cervus Volans*, in natural history, a name given by authors to the stag-fly, or horned beetle, a very large species of beetle with horns sloped, and something like those of the stag.

CERYX, in antiquity. The ceryces were a sort of public criers appointed to proclaim or publish things aloud in assemblies. The *ceryx* among the Greeks answered to the *præco* among the Romans. Our criers have only a small part of their office and authority.

There were two kinds of ceryces, *civil* and *sacred*. The former were those appointed to call assemblies and make silence therein; also to go on messages, and do the office of our heralds, &c. The sacred ceryces were a sort of priests, whose office was to proclaim silence in the public games and sacrifices, publish the names of the conquerors, proclaim feasts, and the like. The priesthood of the ceryces was annexed to a particular family, the descendants of Ceryx, son of Eumolphus. To them it also belonged to lead solemn victime to slaughter. Before the ceremonies began, they called silence in the assembly, by the formula, Ευφημειτε σιγη πας εσω λεως; answering to the *favete linguis* of the Romans. When the service was over, they dismissed the people with this formula, Λαων αφεσις, *Ite missa est*.

CESARE, among logicians, one of the modes of the second figure of syllogisms; the minor proposition of which is an universal affirmative, and the other two universal negatives: thus,

Ce No immoral books ought to be read;
Sa But every obscene book is immoral;
Re Therefore no obscene books ought to be read.

CEÇENA, a town of Romagna in Italy, with a bishop's see, subject to the pope, and seated on the river Savio, in E. Long. 12. 46. N. Lat. 44. 8.

CESPITOSÆ plantæ (from *cespes*, turf or sod) are those plants which produce many stems from one root, and thence form a close thick carpet on the surface of the earth.

*Cespitosæ Paludes*, turf-bogs.

CESSATION, the act of intermitting, discontinuing or interrupting the course of any thing, work, action or the like.

*Cessation of Arms*, an armistice or occasional truce. See Truce.

When the commander of a place finds things reduced to an extremity, so that he must either surrender, or sacrifice the garrison and inhabitants to the mercy of the enemy, he plants a white flag on the breach, or beats the chamade; on which a cessation of arms and hostilities commences, to give room for a capitulation.

CESSIO bonorum, in Scots law, the name of that action by which an insolvent debtor may apply for liberation from prison, upon making over his whole real and personal estate to his creditors.

CESSION, in law, an act by which a person surrenders and transmits to another person a right which belonged to himself. Cession is more particularly used in the civil law for a voluntary surrender of a person's effects to his creditors, to avoid imprisonment. See the article Bankrupt.

In several places the cession carried with it a mark of infamy, and obliged the person to wear a green cap or bonnet; at Lucca, an orange one: to neglect this was to forfeit the privileges of the *cession*. This was originally intended to signify that the cessionary was become poor through his own folly. The Italian lawyers describe the ceremony of cession to consist in striking the bare breech three times against a stone, called *Lapis Vituperii*, in presence of the judge. Formerly it consisted in giving up the girdles and keys in court: the ancients using to carry at their girdles the chief utensils wherewith they got their living; as the scrivener his escritoire, the merchant his bag, &c. The form of cession among the ancient Gauls and Romans was as follows: The cessionary gathered up dust in his left hand from the four corners of the house, and standing on the threshold, holding the door post in his right hand, threw the dust back over his shoulders; then stripping to his shirt, and quitting his girdle and bags, he jumped with a pole over the hedge; hereby letting the world know, that he had nothing left, and that when he jumped all he was worth was in the air with him. This was the cession in criminal matters. In civil cases, it was sufficient to lay a broom, a switch or a broken straw, on the threshold: this was called *chrenecruda per durpillum et festucam*.

Cession, in the ecclesiastical law, is when an ecclesiastical person is created a bishop, or when a parson of a parish takes another benefice, without dispensation, or being otherwise qualified. In both these cases their first benefices became void by cession, without any resignation; and to those livings that the person had, who was created bishop, the king may present for that time, whosoever is patron of them; and in the other case the patron may present: but by dispensation of retainder, a bishop may retain some or all the preferments he was intitled to before he was made bishop.

CESTRUM, bastard jasmine: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 28th order, *Luridæ*. The corolla is funnel-shaped; the stamina each sending out a little tooth about the middle of the inside. There are six species, all of them natives of the warmest parts of America; so cannot be preserved in Britain without artificial heat. They are flowering shrubs, rising in height from five to twelve feet, with flowers of a white, herbaceous, or pale yellow colour. The flowers of one species commonly called *Badmington Jasmine*, have the property of sending out a strong scent after sunset. They may be propagated either by seeds or cuttings.

CESTUI, a French word, signifying *he* or *him*, frequently used in the English law writings. Thus, *Cestui qui trust*, a person who has lands, &c. committed to him for the benefit of another; and if such person does not perform his trust, he is compellable to it in chancery, *Cestui qui vie*, one for whose life any lands, &c. are granted. *Cestui qui use*, a person to whose use any one is infeoffed of lands or tenements. Formerly the feoffees to uses were deemed owners of the

the land, but now the poſſeſſion is adjudged in *ceſtui qui uſe*.

CESTUS, among ancient poets, a fine embroidered girdle ſaid to be worn by Venus, to which Homer aſcribes the power of charming and conciliating love. The word is alſo written *ceſtum* and *ceſton*: it comes from κεϛος, *a girdle*, or other thing embroidered or wrought with a needle; derived, according to Servius, from κεντειν, *pungere*; whence alſo *inceſtus*, a term uſed at firſt for any indecency by undoing the girdle, &c. but now reſtrained to that between perſons near akin. See INCEST.

CETACEOUS, an appellation given to the fiſhes of the whale kind; the characters of which are: they have no gills; there is an orifice on the top of the head, through which they breathe and eject water; and they have a flat or horizontal tail.

Nature on this tribe hath beſtowed an internal ſtructure in all reſpects agreeing with that of quadrupeds; and in a few others the external parts in both are ſimilar. Cetaceous fiſh, like land animals, breathe by means of lungs, being deſtitute of gills. This obliges them to riſe frequently on the ſurface of the water to reſpire, to ſleep on the ſurface, as well as to perform ſeveral other functions. They have the power of uttering ſounds, ſuch as bellowing and making other noiſes denied to genuine fiſh. Like land animals they have warm blood, are furniſhed with organs of generation, copulate, bring forth, and ſuckle their young, ſhowing a ſtrong attachment to them. Their bodies beneath the ſkin are entirely ſurrounded with a thick layer of fat (blubber), analogous to the lard on hogs. The number of their fins never exceed three, *viz.* two pectoral fins, and one back fin; but in ſome ſpecies the laſt is wanting. Their tails are placed horizontally, or flat in reſpect to their bodies; contrary to the direction of thoſe of all other fiſh, which have them in a perpendicular ſite. This ſituation of the tail enables them to force themſelves ſuddenly to the ſurface of the water to breathe, which they are ſo frequently conſtrained to do. Many of theſe circumſtances induced Linnæus to place this tribe among his *mammalia*, or what other writers call *quadrupeds**. To have preſerved the chain of beings entire, he ſhould in this caſe have made the genus of *phocæ* or *ſeals*, and that of the *tricheus* or *manati*, immediately precede the whale, thoſe being the links that connect the mammalia or quadrupeds with the fiſh: for the ſeal is, in reſpect to its legs, the moſt imperfect of the former claſs; and in the manati the hind feet coaleſce, aſſuming the form of a broad horizontal tail.

* See *Zoology*.

Notwithſtanding the many parts and properties which cetaceous fiſh have in common with land animals, yet there ſtill remain others which render it more natural to place them, with Ray, in the rank of fiſh: the form of their bodies agrees with that of fiſh; they are entirely naked, or covered only with a ſmooth ſkin; they live conſtantly in the water, and have all the actions of fiſh.

CETE, the name of Linnæus's ſeventh order of mammalia, comprehending the MONODON, BALÆNA, PHYSETER, and DELPHINUS.

CETERACH, in botany, the trivial name of a ſpecies of ASPLENIUM.

CETTE, a maritime town of France, in Languedoc, ſeated at the place where the canal of Languedoc begins, between Montpellier and Agde, on the bay of Maguelona in the Mediterranean ſea. E. Long. 3. 15. N. Lat. 43. 25.

CETUS, in aſtronomy, the whale; a large conſtellation of the ſouthern hemiſphere, under Piſces, and next the water of Aquarius. The ſtars in the conſtellation Cetus, in Ptolemy's catalogue, are twenty-two; in Tycho's twenty-one; in Hevelius's forty-five; in the Britannic catalogue ninety-ſeven.

Cetus is repreſented by the poets, as the ſea-monſter which Neptune, at the ſuit of the nymphs, ſent to devour Andromeda for the pride of her mother, and which was killed by Perſeus. In the mandible of cetus is a variable ſtar which appears and diſappears periodically, paſſing through the ſeveral degrees of magnitude both increaſing and diminiſhing, in about 333 days. See ASTRONOMY, n° 45.

CEVA, a ſtrong town of Piedmont in Italy, ſeated on the river Tanero, with a ſtrong fort, in E. Long. 8. 8. N. Lat. 44. 20.

CEVENNES, mountains of Languedoc in France, remarkable for the frequent meetings of the Proteſtants there as a place of ſecurity againſt the tyranny of their governors. In queen Anne's reign there was an attempt made to aſſiſt them by an Engliſh fleet in the Mediterranean; but to no purpoſe, for the French had occupied the paſſages.

CEUTA, a maritime town of Barbary in Africa, and in the kingdom of Fez, ſeated on the ſtraits of Gibraltar, oppoſite that place, in W. Long. 6. 25. N. Lat. 36. 35. John king of Portugal took it from the Moors in 1415, but it now belongs to Spain. In 1697, it ſuſtained a vigorous ſiege by the Moors.

CEYLON, a large iſland in the Eaſt Indies, about 250 miles in length and 200 in breadth. It abounds in trees and ſhrubs, valuable both on account of their timber and the gums or ſpices they produce. Among theſe Mr Ives enumerates the euphorbium, tulip-tree, ebony, red-wood, caſſia, cocoa-nut, cotton, lime, mangoe, citron, coffee; the trees producing balſam of capivi, gum gamboge, lac, and *cenquenomale*. This laſt is as yet unknown in Europe; but, according to the information of a Dutch ſurgeon, an oil or balſam is produced from it by diſtillation, which is of great uſe in paralytic complaints. There is alſo another gum named *badule*, which has been but lately diſcovered, and of which the uſe is as yet unknown. Here is alſo the black and yellow *teak*, the wood of which is of a moſt beautiful grain, but ſo hard that the cutting of it proves very duſtructive to the carpenters tools. But the moſt remarkable, as well as the moſt uſeful, of the vegetable productions of Ceylon, is the cinnamon-tree, which grows wild in every wood on the ſouth-weſt part of the iſland. The very young trees are not fit for rinding, and the old ones are cut down for firewood. The common flowering ſhrubs, of which the whole iſland is full, ſend forth a moſt agreeable fragrance every morning and evening. It abounds with high hills, between which the ſoil is a fat red earth; and the valleys are extremely pleaſant, having a clear rivulet running thro' almoſt every one of them. Thus the fineſt fruits grow in vaſt plenty, and may be had at the moſt trifling rates; a pine-apple being bought for leſs than a penny, and ſo of the reſt. Other proviſions are almoſt equally cheap;

cheap; a dozen of fowls or five ducks being ſold for a rupee, not quite half-a-crown of Engliſh money. Here the Dutch ſhow a poiſonous fruit called by them *Adam's apple*. In ſhape it reſembles the quarter of an apple cut out, with the two inſides a little convex, and a continued ridge along the outer edges; and is of a beautiful orange colour. Pepper, ginger, and cardamoms, are alſo produced here; as well as five kinds of rice, which ripen one after another.

Ceylon produces alſo topazes, garnets, rubies, and other precious ſtones, which are diſcovered by waſhing the ſoil wherein they grow. It has likewiſe ores of copper, iron, and probably of tin, with veins of black cryſtal.

Common deer are found in this iſland in great abundance, as well as Guinea-deer; but the horned cattle are both very ſmall and ſcarce, ſix of them weighed all together, but 714 pounds, and one of theſe weighed, only 70 pounds. They have, however, the largeſt and beſt elephants in the world; and their woods are infeſted by tygers, the moſt terrible of all ravenous beaſts. They abound alſo with ſnakes of a monſtrous ſize, one of which has been known to deſtroy a tyger and devour him at one meal. Mr Ives ſaw one 15 feet long and 30 inches in circumference. Spiders, centipedes, and ſcorpions, alſo grow here to an enormous ſize. Our author ſaw a ſpider here as large as a toad, with brown hair upon it, and legs as thick as the ſhank of a large tobacco-pipe. A ſcorpion, taken out of a piece of wood, was eight inches long, from head to tail, excluſive of the claws; the ſhell was as hard as that of a crab: and our author killed a centipede more than ſeven inches long. Here the *mantis* or creeping leaf is met with; which our author ſuppopoſes to be a ſpecies of graſshoppers, having every member we ſee in common inſects, though in ſhape and appearance it greatly reſembles a leaf. It is of a green colour. The ſea-coaſts abound with fiſh, which are to be had very cheap. Neither harp-ſhells nor ventletraps are to be met with here: but there are abundance of painted cockles, and others commonly called *panama ſhells*.

"The natives of this iſland (ſays our author) are the ſtouteſt Indians I ever ſaw. Mr Knox in his hiſtory reports many ſtrange things of their religion and cuſtoms, none of which I had any opportunity of ſeeing. He ſays 'that they have various ways of treating their dead. Some burn them, which is not uncommon in India; while others throw their limbs up into the forks of trees.' This may be true, becauſe when our wood-cutters were once hewing down a ſtick of timber, there fell from it the ſkull and many bones of a human body; and I alſo ſaw here a human body hanging on a tree. Other hiſtorians relate, that the natives of Ceylon feed on human fleſh; nay, that they eat the bodies of their deceaſed parents, imagining that no other ſepulchre is ſo fit for them as their own bowels, ſince thereby they think they are changed into their own ſubſtance, and live again in themſelves. This ſhocking cuſtom is reported of the ancient Scythians, and poſſibly might have been uſed by the inhabitants of Ceylon, but is now in both countries entirely aboliſhed; and yet even at this day theſe iſlanders are ſaid to make cups of their parents ſkulls, with a view, that in midſt of their mirth and jollity they may be ſure to preſerve a reſpectful remembrance of them."

The Ceyloneſe make uſe of boats hollowed out of the trunks of trees, which are about 12 or 14 feet long, but only as many inches broad within. The tree part in the bottom is much larger; but when the boat, on account of the ſize of the tree, is too ſmall, they make a trough on the top of it ſquare at both ends. Some boats, however, are much larger, being built between two trees; and with theſe they coaſt along ſhore; the others are for fiſhermen. It lies from E. Long. 78° to 82°, and from N. Lat. 6° to 10.

The conqueſt of this iſland was the firſt attempt of Albuquerque the celebrated Portugueſe admiral. He found it well peopled, and inhabited by two different nations, the *Bedas* inhabiting the northern, and the *Cinglaſſes* who dwelt in the ſouthern parts. The former were very barbarous, but the latter a good deal more poliſhed. Beſides the advantages already mentioned, which theſe nations derived from their mines of precious ſtones, they carried on the greateſt pearl-fiſhery in the Eaſt. Theſe nations the Portugueſe conquered, and tyrannized over in ſuch a manner, that they aſſiſted the Dutch in expelling them from the iſland; and by their united efforts this was accompliſhed in 1658, after a bloody and obſtinate war. All the Portugueſe ſettlements fell into the hands of the Dutch Eaſt India company, who ſtill keep poſſeſſion of them, excepting a ſmall diſtrict on the eaſtern coaſt without any port, from whence the ſovereign of the country had his ſalt. Theſe ſettlements formed a regular track, extending from two to twelve leagues into the inland parts of the iſland. The company have appropriated all the productions of the iſland. The ſeveral articles of trade are, 1. Amethyſts, ſapphires, topazes, and rubies; the laſt are very ſmall, and very indifferent. The Moors who come from the coaſt of Coromandel buy them, paying a moderate tax: and when they are cut, ſell them at a low price in the different countries of India. 2. Pepper, which the company buy for about 4d. *per* pound; coffee, for which they only pay 2d. and cardamom, which has no fixed price. Theſe articles are all of an inferior quality, and through the indolence of the inhabitants will never turn to any account. 3. An hundred bales of handkerchiefs, pagnes, and ginghams, of a fine red colour, which are fabricated by the Malabars of Jafranapatan. 4. A ſmall quantity of ivory, and about 50 elephants, which are carried to the coaſt of Coromandel. 5. Areca, which the company buys at about 8s. 9d. the ammonan, and ſells on the ſpot at L. 1, 13s. to the merchants of Bengal, Coromandel, and the Maldives; who give in return rice, coarſe linen, and cowries. 6. The pearl fiſhery, which was formerly of great conſequence; but is now ſo much exhauſted as not to bring in more than L. 8,750 *per annum*. 7. After all, the great object of the company is cinnamon. They purchaſe the greateſt part of their cinnamon of the Indians who are ſubject to them, and, all expences deducted, it does not coſt them above 6d. *per* pound. The annual expences of the colony may amount to about L. 96,250; their revenues and ſmall branches of commerce produce only about L. 87,500. —This deficiency muſt be ſupplied out of the pro-

fits

fits arising from the cinnamon trade; and they are obliged to provide for the expences of the wars in which they are frequently engaged with the king of Candy, who is at present the sole sovereign of the island. These are very detrimental to the interests of the Hollanders; for which reason they endeavoured to engage the good will of this monarch by showing him all imaginable civilities. The harmony, however, has been often interrupted. In a bloody war which terminated on the 14th of February 1766, the Ceylonese monarch was driven from his capital, so that the Dutch made a very advantageous treaty. Their sovereignty was acknowledged over all that part of the country they possessed before the troubles broke out; and that part of the coasts held by the natives was ceded to them. They were allowed to gather cinnamon in all the plains; and the court was to sell them the best sort, which is produced in the mountains, at the rate of L. 1 : 16 : 8, for 18 *lb*. The government engaged to have no connection with any foreign power; and even to deliver up any Europeans who might happen to stray into the island. In return for so many concessions, the king was to receive annually the value of the produce of the ceded coasts; and from thence his subjects were to be furnished gratis with as much salt as they had occasion for. The Ceylonese are in the most miserable situation: they are in a state of total inactivity; live in huts without any furniture; and subsist upon fruits: those who are the most affluent have no other covering than a piece of coarse linen wrapt about their waist.

CHACE. See CHASE.

CHACO, a large country of South America situated between 19° and 37° S. Lat. It belongs to the Spaniards, by whom it was conquered in 1536. It is not naturally fruitful; but abounds in gold mines, which are so much the more valuable that they are easily worked. The works are carried on by about 8000 blacks, who deliver every day to their masters a certain quantity of gold; and what they can collect above this, belongs to themselves; as well as what they find on those days that are consecrated to religion and rest, upon condition that during the festival they maintain themselves. This enables many of them to purchase their liberty; after which they intermarry with the Spaniards.

CHADCHOD, in Jewish antiquity. Ezekiel mentions *chadchod* among the several merchandizes which were brought to Tyre. The old interpreters, not very well knowing the meaning of this term, continued it in their translation. St Jerom acknowledges that he could not discover the interpretation of it. The Chaldee interprets it pearls; others think that the onyx, ruby, carbuncle, crystal or diamond is meant by it.

CHÆRONEA, (anc. geog.) the last town, or rather the last village, of Bœotia, towards Phocis; the birth-place of Plutarch: famous for the fatal defeat of the confederate Greeks by Philip of Macedon. This place was considered by Philip as well adapted to the operations of the Macedonian phalanx; and the ground for his encampment, and afterwards the field of battle, were chosen with equal sagacity: having in view on one side a temple of Hercules, whom the Macedonians regarded as the author of their royal house, and the high protector of their fortune; and on the other the banks of the Thermodon, a small river flowing into the Cephissus, announced by the oracles of Greece as the destined scene of desolation and woe to their unhappy country. The generals of the confederate Greeks had been much less careful to avail themselves of the powerful sanctions of superstition. Unrestrained by inauspicious sacrifices, the Athenians had left their city at the exhortation of Demosthenes, to wait no other omen but the cause of their country. Regardless of oracles, they afterwards advanced to the ill-fated Thermodon, accompanied by the Thebans, and the scanty reinforcements raised by the islands and states of Peloponnesus which had joined their alliance. Their army amounted to 30,000 men, animated by the noblest cause for which men can fight, but commanded by the Athenians Lysicles and Chares; the first but little, and the second unfavourably, known; and by Theagenes the Theban, a person strongly suspected of treachery: all three creatures of cabal and tools of faction, slaves of interest or voluptuousness, whose characters (especially as they had been appointed to command the only states whose shame, rather than virtue, yet opposed the public enemy) are alone sufficient to prove that Greece was ripe for ruin.

When the day approached for abolishing the tottering independence of those turbulent republics, which their own internal vices, and the arms and intrigues of Philip, had been gradually undermining for 22 years, both armies formed in battle array before the rising of the sun. The right wing of the Macedonians was headed by Philip, who judged proper to oppose in person the dangerous fury of the Athenians. His son Alexander, only 19 years of age, but surrounded by experienced officers, commanded the left wing, which faced the Sacred Band of the Thebans. The auxiliaries of either army were posted in the centre. In the beginning of the action, the Athenians charged with impetuosity, and repelled the opposing divisions of the enemy; but the youthful ardour of Alexander obliged the Thebans to retire, the Sacred Band being cut down to a man. The activity of the young prince completed their disorder, and pursued the scattered multitude with his Thessalian cavalry.

Meantime the Athenian generals, too much elated by their first advantage, lost the opportunity to improve it; for having repelled the centre and right wing of the Macedonians, except the phalanx, which was composed of chosen men, and immediately commanded by the king, they, instead of attempting to break this formidable body by attacking it in flank, pressed forward against the fugitives, the insolent Lysicles exclaiming in vain triumph, "Pursue, my brave countrymen! let us drive the cowards to Macedon." Philip observed this rash folly with contempt; and saying to those around him, "Our enemies know not how to conquer," commanded his phalanx, by a rapid evolution, to gain an adjacent eminence, from which they poured down, firm and collected, on the advancing Athenians, whose confidence of success had rendered them totally insensible to danger. But the irresistible shock of the Macedonian spear converted their fury into despair. Above a thousand fell, two thousand were taken prisoners;

soners; the rest escaped by a precipitate and shameful flight. Of the Thebans more were killed than taken. Few of the confederates perished, as they had little share in the action, and as Philip, perceiving his victory to be complete, gave orders to spare the vanquished, with a clemency unusual in that age, and not less honourable to his understanding than his heart; since his humanity thus subdued the minds, and gained the affections, of his conquered enemies.

According to the Grecian custom, the battle was followed by an entertainment, at which the king presiding in person, received the congratulations of his friends, and the humble supplications of the Athenian deputies, who craved the bodies of their slain. Their request, which served as an acknowledgement of their defeat, was readily granted; but before they availed themselves of the permission to carry off their dead, Philip, who with his natural intemperance had protracted the entertainment till morning, issued forth with his licentious companions to visit the field of battle; their heads crowned with festive garlands, their minds intoxicated with the insolence of wine and victory; yet the sight of the slaughtered Thebans, which first presented itself to their eyes, and particularly the sacred band of friends and lovers, who lay covered with honourable wounds on the spot where they had been drawn up to fight, brought back these insolent spectators to the sentiments of reason and humanity. Philip beheld the awful scene with a mixture of admiration and pity; and, after an affecting silence, denounced a solemn curse against those who basely suspected the friendship of such brave men to be tainted with criminal and infamous passions.

But this serious temper of mind did not last long; for having proceeded to that quarter of the field where the Athenians had fought and fallen, the king abandoned himself to all the levity and littleness of the most petulent joy. Instead of being impressed with a deep sense of his recent danger, and with dutiful gratitude to Heaven for the happiness of his escape and the importance of his victory, Philip only compared the boastful pretensions with the mean performances of his Athenian enemies; and, struck by this contrast, rehearsed, with the insolent mockery of a buffoon, the pompous declaration of war lately drawn up by the ardent patriotism and too sanguine hopes of Demosthenes. It was on this occasion that the orator Demades at once rebuked the folly, and flattered the ambition of Philip, by asking him, Why he assumed the character of Thersites when fortune assigned him the part of Agamemnon?

Whatever might be the effect of this sharp reprimand, it is certain that the king of Macedon indulged not, on any future occasion, a vain triumph over vanquished. When advised by his generals to advance into Attica, and to render himself master of Athens, he only replied, "Have I done so much for glory, and shall I destroy the theatre of that glory?" His subsequent conduct corresponded with the moderation of this sentiment. He restored without ransom the Athenian prisoners; who, at departing, having demanded their baggage, were also gratified in this particular; the king pleasantly observing, that the Athenians seemed to think he had not conquered them in earnest. Soon afterwards he dispatched his son Alexander, and Antipater, the most trusted of his ministers, to offer them peace on such favourable terms as they had little reason to expect. They were required to send deputies to the Isthmus of Corinth, where, to adjust their respective contingents of troops for the Persian expedition, Philip proposed assembling early in the spring a general convention of all the Grecian states: they were ordered to surrender the isle of Samos, which actually formed the principal station of their fleet, and the main bulwark and defence of all their maritime or insular possessions; but they were allowed to enjoy, unmolested, the Attic territory, with their hereditary form of government.

CHÆROPHYLLUM, Chervil: A genus of the digynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The involucrum is reflexed-concave; the petals inflexed-cordate; the fruit oblong and smooth. There are seven species, two of which, called cow-weed and wild chervil, are weeds common in many places of Britain. The roots of the first have been found poisonous when used as parsnips: the rundles afford an indifferent yellow dye; the leaves and stalks a beautiful green. Its presence indicates a fertile and grateful soil. It ought to be rooted out from all pastures early in the spring, as no animal but the ass will eat it. It is one of the most early plants in shooting, so that by the beginning of April the leaves are near two feet high. The leaves are recommended by Geoffroy as aperient and diuretic, and at the same time grateful to the palate and stomach. He even asserts, that dropsies which do not yield to this medicine can scarcely be cured by any other. He directs the juice to be given in the dose of three or four ounces every fourth hour, and continued for some time either alone, or in conjunction with nitre and syrup of the five opening roots.—The other species of chærophyllum are not possessed of any remarkable property.

CHÆTODON, in ichthyology, a genus of fishes belonging to the order of thoraci. The teeth are very numerous, thick, setaceous, and flexile; the rays of the gills are six. The back-fin and the fin at the anus are fleshy and squamous. There are 23 species, distinguished from each other principally by the figure of the tail, and the number of spines in the back-fin. The most remarkable is the rostratus, or shooting-fish, having a hollow, cylindrical beak. It is a native of the East Indies, where it frequents the sides of the sea and rivers in search of food, from its singular manner of obtaining which it receives its name. When it spies a fly sitting on the plants that grow in shallow water, it swims on to the distance of four, five, or six feet; and then, with a surprising dexterity, it ejects out of its tubular mouth a single drop of water, which never fails striking the fly into the water, where it soon becomes its prey.

CHAFF, in husbandry, the husks of the corn, separated by screening or winnowing it. It signifies also the rind of corn, and straw cut small for the use of cattle.

Chaff-*Cutter*, a machine for making chaff to feed horses.—The advantages of an easy and expeditious method of cutting straw into chaff by an engine which could be used by common labourers have been long

Chaff-cutter. || Chaffery.

long acknowledged, and various attempts have been made to bring such an engine to perfection. But the objections to most of them have been their complicated structure, their great price, and the noise they make in working; all which inconveniences seem to have been lately removed by an invention of Mr James Pike watchmaker of Newton Abbot in Devonshire. Of his engine, which is of a simple and cheap construction, the following description, and figure referred to, are extracted from the Transactions of the Society of Arts for 1787.

The engine is fixed on a wood frame, which is supported with four legs, and on this frame is a box for containing the straw, four feet six inches long, and about ten inches broad; at one end is fixed across the box two rollers inlaid with iron, in a diagonal line about an eighth of an inch above the surface; on the ends of these rollers are fixed two strong brass wheels, which takes one into the other. On one of these wheels is a contrect wheel, whose teeth take in a worm on a large arbour; on the end of this arbour is fixed a wooden wheel, two feet five inches diameter and three inches thick; on the inside-part of this wheel is fixed a knife, and every revolution of the wheel the knife passes before the end of the box and cuts the chaff, which is brought forward between the rollers, which are about two inches and a half asunder; the straw is brought on by the worm taking one tooth of the wheel every round of the knife; the straw being so hard pressed between the rollers, the knife cuts off the chaff with so great ease, that twenty-two bushels can be cut within the hour, and makes no more noise than is caused by the knife passing through the chaff.

Plate CXXXVI. *A* is the box into which the straw is put. *B*, the upper roller, with its diagonal projecting ribs of iron, the whole moving by the revolution of the brass wheel *C* on the axis of which it is fixed. *D*, a brass wheel, having upon it a face wheel, whose teeth take into the endless screw on the arbour *E*, while the teeth on the edge of this wheel enter between those on the edge of the wheel *C*. On the axis of the wheel *D* is a roller, with iron ribs similar to *B*, but hid within the box. *E*, the arbour, one of the ends of which being made square and passing through a mortise in the centre of the wooden wheel *F*, is fastened by a strong screw and nut; the other end of this arbour moves round in a hole within the wooden block *G*. *H*, the knife, made fast by screws to the wooden wheel *F*, and kept at the distance of nearly three quarters of an inch from it by means of a strip of wood of that thickness, of the form of the blade, and reaching to within an inch of the edge. *I*, the handle mortised into the outside of the wooden wheel *F*.

CHAFFER, in zoology, a species of beetle. See SCARABÆUS.

CHAFFERCONNERS, in commerce, printed linens manufactured in the Great Mogul's dominions. They are imported by the way of Surat; and are of the number of those linens prohibited in France.

CHAFFERY, in the iron-works, the name of one of the two principal forges. The other is called the *finery*. When the iron has been brought at the finery into what is called an ancony, or square mass, hammered into a bar in its middle, but with its two ends rough, the business to be done at the chaffery is the reducing the whole to the same shape, by hammering down these rough ends to the shape of the middle part.

Chaf || Cha

CHAFFINCH, in ornithology, the English name of a species of FRINGILLA.

CHAGRE, a fort of America in the province of Darien at the mouth of a river of the same name. It has been taken several times by the buccaneers, and last of all by Admiral Vernon in 1740. W. Long. 82. 7. N. Lat. 9. 50.

CHAIN, *(Catena)* a series of several rings, or links, fitted into one another.

There are chains of divers matters, sizes, forms, and for divers uses.—Ports, rivers, streets, &c. are closed with iron chains: rebellious cities are punished by taking away their chains and barriers.

The arms of the kingdom of Navarre are, *Chains, Or, in a field Gules*. The occasion hereof is referred to the kings of Spain leagued against the Moors; who having gained a celebrated victory against them in 1212, in the distribution of the spoils the magnificent tent of Miralmumin fell to the king of Navarre, as being the first that broke and forced the chains thereof.

*A gold* CHAIN, is one of the ornaments or badges of the dignity of the chief magistrates of a city, as the mayor of London, the provost and bailies of Edinburgh, &c.—Something like this obtained among the ancient Gauls: the principal ornament of their persons in power and authority was a gold chain, which they wore on all occasions; and even in battle, to distinguish them from the common soldiers.

CHAIN also denotes a kind of string, of twisted wire; serving to hang watches, tweezer-cases, and other valuable toys upon. The invention of this piece of curious work is owing to the English; whence, in foreign countries, it is denominated the *English chain*. These chains are usually either of silver or gold, some of gilt copper; the thread or wire of each kind to be very fine.—For the fabric, or making of these chains: a part of the wire is folded into little links of an oval form; the longest diameter about three lines; the shortest one. These, after they have been exactly soldered, are again folded into two; and then bound together or interwove, by means of several other little threads of the same thickness; some whereof, which pass from one end to the other, imitate the warp of a stuff; and the others, which pass transverse, the woof. There are at least four thousand little links in a chain of four pendants; which are by this means bound so equally, and withal so firmly together, that the eye is deceived, and takes the whole to consist of one entire piece.

CHAIN is also a kind of measure in France, in the trade of wood for fuel. There are chains for wood by tale, for wood by the rope, for faggots, for cleft wood, and for round sticks. There are also chains for measuring the sheaves of all sorts of corn, particularly with regard to the payment of tithes; for measuring pottles of hay, and for measuring horses. All these are divided into feet, inches, hands, &c. according to the use they are designed for.

CHAIN, in surveying, is a measure, consisting of a certain number of links of iron wire, usually a hundred; serving to take the dimensions of fields, &c. This

This is what Merfenne takes to be the arvipendium of the ancients.

The chain is of various dimenfions, as the length or number of links varies: that commonly ufed in meafuring land, called Gunter's chain, is in length four poles or perches: or fixty-fix feet, or a hundred links; each link being feven inches $\frac{92}{100}$. Whence it is eafy to reduce any number of thofe links to feet, or any number of feet to links.

This chain is entirely adapted to Englifh meafures; and its chief convenience is in finding readily the numbers contained in a given field. Where the proportions of fquare feet and acres differ, the chain, to have the fame advantages as Gunter's chain, muft alfo be varied. Thus in Scotland, the chain ought to be of 74 feet, or 24 Scotch ells, if no regard be had to the difference between the Scotch and Englifh foot; but if regard be had to this difference, the Scotch chain ought to confift of $74\frac{2}{5}$ Englifh feet, or 74 feet 4 inches and $\frac{4}{5}$ of an inch. This chain being divided into an hundred links, each of thefe will be $8\frac{928}{1000}$ inches.

That ordinarily ufed for large diftances, is in length a hundred feet; each link one foot. For fmall parcels, as gardens, &c. is fometimes ufed a fmall chain of one pole, or fixteen feet and a half length; each link one inch $\frac{98}{100}$.

Some in lieu of chains ufe ropes; but thefe are liable to feveral irregularities; both from the different degrees of moifture, and of the force which ftretches them. Schwenterus, in his Practical Geometry, tells us, he has obferved a rope fixteen feet long, reduced to fifteen in an hour's time, by the mere falling of a hoar froft. To obviate thefe inconveniences, Wolfius directs, that the little ftrands whereof the rope confifts be twifted contrary ways, and the rope dipped in boiling hot oil; and when dry, drawn through melted wax. A rope thus prepared, will not get or lofe any thing in length, even though kept under water all day.

*Chain-Pump*. See Pump.

*Chain-Shot*, two bullets with a chain between them. They are ufed at fea to fhoot down yards or mafts, and to cut the fhrouds or rigging of a fhip.

*Top-Chain*, on board a fhip, a chain to fling the fail-yards in time of battle, in order to prevent them from falling down when the ropes by which they are hung happen to be fhot away or rendered incapable of fervice.

Plate XXXVI. *Chain-Wales*, or *Channels*, of a fhip, *porteboiffoirs*, are broad and thick planks projecting horizontally from the fhip's outfide, abreaft of and fomewhat behind the mafts. They are formed to extend the fhrouds from each other, and from the axis or middle line of the fhip, fo as to give a greater fecurity and fupport to the mafts, as well as to prevent the fhrouds from damaging the gunwale, or being hurt by rubbing againft it. Every maft has its chain-wales, which are either built above or below the fecond deck-ports in a fhip of the line: they are ftrongly connected to the fide by knees, bolts, and ftandards, befides being confined thereto by the chains whofe upper ends pafs through notches on the outer edge of the chain-wales, fo as to unite with the fhrouds above.

Chains, in fhip-building, are ftrong links or plates of iron, the lower ends of which are bolted through the fhip-fide to the timbers.



*Hanging in Chains*, a kind of punifhment inflicted on murderers. By ftat. 25. Geo. II. c. 37. the judge fhall direct fuch to be executed on the next day but one, unlefs Sunday intervene; and their bodies to be delivered to the furgeons to be diffected and anatomized: and he may direct them afterwards to be hung in chains. During the interval between fentence and execution, the prifoner fhall be kept alone, and fuftained only with bread and water. The judge, how ever, hath power to refpite the execution, and relax the other reftraints of the act.

*Chain-Ifland*, an ifland lately difcovered by captain Wallis in the South-fea. It feemed to be about five miles long and as much broad, lying in the direction of north-weft and fouth-eaft. It appeared to be a double range of woody iflands joined together by reefs, fo as to compofe one ifland of an oval figure, with a lake in the middle. The trees are large; and from the fmoke that iffued from the woods, it appeared to be inhabited. W. Long. 145. 54. S. Lat. 17. 23.

CHAJOTLI, or Chayoti, a Mexican fruit of a round fhape, and fimilar in the hufk with which it is covered to the chefnut, but four or five times larger, and of a much deeper green colour. Its kernel is of a greenifh white, and has a large ftone in the middle, which is white, and like it in fubftance. It is boiled, and the ftone eat with it. This fruit is produced by a twining perennial plant, the root of which is alfo good to eat. See Plate CXXXVIII.

CHAIR, (*Cathedra*) was anciently ufed for the pulpit, or fuggeftum, whence the prieft fpoke to the people.

It is ftill applied to the place whence profeffors and regents in univerfities deliver their lectures, and teach the fciences to their pupils: thus, we fay, the profeffor's chair, the doctor's chair, &c.

*Curule Chair*. was an ivory feat placed on a car, wherein were feated the prime magiftrates of Rome, and thofe to whom the honour of a triumph had been granted.

*Sedan Chair*, a vehicle fupported by poles, wherein perfons are carried; borne by two men. There are two hundred chairs allowed by act of parliament in London; and no perfon is obliged to pay for a hackney-chair more than the rate allowed by the act for a hackney-coach driven two-third parts of the faid diftance. 9 Ann. c. 23. § 8. Their number is fince increafed, by 10 Ann. c. 19. and 12 Geo. I. c. 12. to four hundred. See *Hackney-Coaches*.

Chair is alfo applied by the Romanifts to certain feafts, held anciently in commemoration of the tranflation of the fee, or feat of the vicarage of Chrift, by St Peter.

The perforated chair, wherein the new-elected pope is placed, F. Mabillon obferves, is to be feen at Rome: but the origin thereof he does not attribute, as is commonly done, to the adventure of Pope Joan; but fays there is a myftery in it; and it is intended, to explain to the pope thofe words of fcripture, that *God draws the poor from out of the duft and mire*.

CHAIRMAN, the president, or fpeaker of an affembly, assembly, company, &c. We say, the chairman of a committee, &c.

CHAISE, a sort of light open chariot, or calash.

Aurelius Victor relates, that Trajan first introduced the use of post-chases: but the invention is generally ascribed to Augustus; and was probably only improved by Trajan, and succeeding emperors.

CHALAZA, among naturalists, a white knotty sort of string at each end of an egg, formed of a plexus of the fibres of the membranes, whereby the yolk and white are connected together. See EGG.

CHALCAS, in botany: A genus of the monogynia order, belonging to the pentandria class of plants. The calyx is quinquepartite; the corolla campanulated, with the petals heeled; the stigma round-headed and warty.

CHALCEDON, or CALCEDON, anciently known by the names of *Procerastis* and *Colbusa*; a city of Bithynia, situated at the mouth of the Euxine, on the north extremity of the Thracian Bosphorus, over against Byzantium. Pliny, Strabo, and Tacitus, call it *The City of the Blind*; alluding to the answer which the Pythian Apollo gave to the founders of Byzantium, who, consulting the oracle relative to a place where to build a city, were directed to choose that spot which lay opposite "to the habitation of the blind;" that is, as was then understood, to Chalcedon: the Chalcedonians well deserving that epithet for having built their city in a barren and sandy soil, without seeing that advantageous and pleasant spot on the opposite shore, which the Byzantines afterwards chose.—Chalcedon, in the Christian times, become famous on account of the council which was held there against Eutyches. The emperor Valens caused the walls of this city to be levelled with the ground for siding with Procopius, and the materials to be conveyed to Constantinople, where they were employed in building the famous Valentinian aqueduct. Chalcedon is at present a poor place, known to the Greeks by its ancient name, and to the Turks by that of *Cadiaci*, or "the judges town."

CHALCEDONY, in natural history, a genus of the semipellucid gems. They are of an even and regular, not tabulated structure; of a semi-opaque crystalline basis; and variegated with different colours, but those ever disposed in form of mists or clouds, and, if nicely examined, found to be owing to an admixture of various coloured earths, but imperfectly blended in the mass, and often visible in distinct moleculæ.—It has been doubted by some whether the ancients were at all acquainted with the stone we call *chalcedony*; they having described a Chalcedonian carbuncle and emerald, neither of which can at all agree with the characters of our stone; but we are to consider that they have also described a Chalcedonian jasper which seems to have been the very same stone as they describe by the word *turbida*, which extremely well agrees with our chalcedony.

There are four known species of the chalcedony. 1. A bluish white one. This is the most common of all, and is found in the shape of flints and pebbles, in masses of two or three inches or more in diameter. It is of a whitish colour, with a faint cloud of blue diffused all over it, but always in the greatest degree near the surface. This is a little less hard than the oriental onyx. The oriental chalcedonies are the only ones of any value; they are found in vast abundance on the shores of rivers in all parts of the East-Indies, and frequently come over among the ballast of the East-India ships. They are common in Silesia and Bohemia, and other parts of Europe also; but with us are less hard, more opaque, and of very little value. 2. The dull milky-veined chalcedony. This is a stone of little value, and is sometimes met with among the lapidaries, who mistake it for a kind of nephritic stone. It is of a somewhat yellowish white or cream colour, with a few milk-white veins. This is principally found in New-Spain. 3. The third is a brownish, black, dull, and cloudy one, known to the ancients by the name of smoky jasper, or jaspis capnitis. This is the least beautiful stone of all the class: it is of a pale brownish white, clouded all over with a blackish mist, as the common chalcedony is with a blue. It is common both in the East and West-Indies, and in Germany; but is very little valued, and is seldom worked into any thing better than the handles of knives. 4. The yellow and red chalcedony is greatly superior to all the rest in beauty; and is in great repute in Italy, though very little known among us. It is naturally composed of an admixture of red and yellow only, on a clouded crystalline basis; but is sometimes found blended with the matter of common chalcedony, and then is mixed with blue. It is all over of the misty hue of the common chalcedony. This is found only in the East-Indies, and there not plentifully. The Italians make it into beads, and call these *cassidonies*; but they are not determinate in the use of the word, but call beads of several of the agates by the same name.—All the chalcedonies readily give fire with steel, and make no effervescence with aquafortis.



CHALCIDENE, or CHALCIDICE, (anc. geog.) an inland country of Syria, having Antiochis or Seleucia to the west, Cyrrhestica to the north, to the south Apamene and Cœlesyria, and to the east Chalybonitis; being so called from its principal city Chalcis. This province, one of the most fruitful in Syria, was seized by Ptolemy the son of Mennæus during the troubles of Syria, and by him made a separate kingdom. Ptolemy himself is styled by Josephus and Hegesippus only Prince of Chalcis, but his son Lysanias is honoured both by Josephus and Dio with the title of King. Upon the death of Antiochus Dionysius king of Syria, Ptolemy attempted to make himself master of Damascus and all Cœlesyria; but the inhabitants, having an utter aversion to him on account of his cruelty and wickedness, chose rather to submit to Aretas king of Arabia, by whom Antiochus and his whole army had been cut off. He opposed Pompey on his entering Syria; but was by him defeated, taken prisoner, and sentenced to death; which, however, he escaped by paying a thousand talents, and was left also in the possession of his kingdom. After Aristobulus king of Judæa had been poisoned by the friends of Pompey, and Alexander his son beheaded at Antioch, he sent Philippion his son to Ascalon, whither the widow of Aristobulus had retired with her other children, to bring them all to Chalcis; proposing, as he was in love with one of the daughters named Alexandria, to maintain them in his own kingdom in a manner suitable to their rank: but Philippion like-

 wise

wife being in love with Alexandria, married her on the way; for which presumption Ptolemy put him to death on his return, and then took her to wife. On account of this affinity, he supported to the utmost of his power Antigonus the younger son of Aristobulus who took the field at the head of a considerable army, but on his entering Judæa was entirely defeated by Herod. Ptolemy soon after died, and was succeeded by his son Lysanias; who, espousing the cause of the Asmonæan family with great warmth, promised to Barzapharnes who command the Parthian troops in Syria, and to Pacorus the king's son, a thousand talents and five hundered women, provided they should put Antigonus in possession of the kingdom of Judæa, and depose Hyrcanus. He was not long after put to death by Marc Antony, at the instigation of Cleopatra; who, in order to have his dominions, accused him falsely of having entered into an alliance with the Parthians.

CHALCIDIC, CHALCIDICUM, or CHALCEDONIUM, in the ancient architecture, a large magnificent hall belonging to a tribunal or court of justice.—Festus says, it took its name from the city of Chalcis; but he does not give the reason. Philander will have it to be the court or tribunal where affairs of money and coinage were regulated; so called from χαλκος *brass*, and δικη *justice*. Others say the money was struck in it; and derive the word from χαλκος, and οικος, *house*. In Vitruvius, it is used for the auditory of a basilica; in other of the ancient writers for a hall or apartment where the heathen imagined their gods to eat.

CHALCIDICE, (anc. geog.) an eastern district of Macedonia, stretching northwards between the Sinus Toronæus and Singiticus. Formerly a part of Thrace, but invaded by Philip of Macedon. Named from the city Chalcis near Olynthus.

CHALCIDIUS, a famous platonic philosopher in the third century, who wrote a commentary, which is esteemed, on the Timæus of Plato. This work has been translated from the Greek into Latin.

CHALCIS, a city of Chalcidice. See CHALCIDICE. (anc. geog.)—Another of Ætolia, near the mouth of the river Evenus, on the Ionian Sea, at the foot of a cognominal mountain; and therefore called by some *Hypochalcis*.—Another of Eubœa (Strabo), on the Euripus, the country of Lycophron the poet, one of the seven which formed the constellation Pleiades. Now *Negrŏponte*. E. Long. 24. 30. Lat. 38. 30.—A fourth, the capital of Chalcidene in Syria; distinguished by the surnames *ad Belum*, a mountain or a river; and *ad Libanum*, from its situation (Pliny).

CHALCITIS, one of the divisions or districts of Mesopotamia, to the south of Anthemusia, the most northern district, next to Armenia, and situated between Edessa and Carræ. *Chalcitis* (Pliny), an island opposite to Chalcedon.

CHALCONDYLAS, (Demetrius) a learned Greek, born at Constantinople, left that city after its being taken by the Turks, and afterwards taught Greek in several cities in Italy. He composed a Greek grammar; and died at Milan in 1513.

CHALCONDYLAS, (Laonicus) a famous Greek historian of the 15th century, was born at Athens; and wrote an excellent history of the Turks, from Ottoman, who reigned about the year 1300, to Mahomet II. in 1463.

CHALDEA, (anc. geog) taken in a larger sense, included Babylonia; as in the prophecies of Jeremiah and Ezekiel. In a restricted sense, it denoted a province of Babylonia, towards Arabia Deserta; called in Scripture *The land of the Chaldeans*. Named from Chased the fourth son of Nahor. See BABYLONIA.

CHALDEE LANGUAGE, that spoken by the Chaldeans or people of Chaldea. It is a dialect of the HEBREW.

*CHALDEE Paraphrase*, in the rabbinical style, is called TARGUM. There are three Chaldee paraphrases in Walton's Polyglot; *viz*. that of Onkelos, that of Jonathan son of Uziel, and that of Jerusalem.

CHALDRON, a dry English measure, consisting of thirty six bushels, heaped up according to the sealed bushel kept at Guildhall, London; but on shipboard, twenty-one chaldrons of coals are allowed to the score. The chaldron should weigh two thousand pounds.

CHALICE, the cup or vessel used to administer the wine in the sacrament, and by the Roman Catholics in the mass.

The use of the chalice, or communicating in both kinds, is by the church of Rome denied to the laity, who communicate only in one kind, the clergy alone being allowed the privilege of communicating in both kinds.

CHALK, *Creta*, is a white earth found plentifully in Britain, France, Norway, and other parts of Europe, said to have been anciently dug chiefly in the island of Crete, and thence to have received its name of *Creta*. They have a very easy way of digging chalk in the county of Kent in England. It is there found on the sides of hills; and the workmen undermine it so far as appears proper; then digging a trench at the top as far distant from the edge as the undermining goes at bottom, they fill this with water, which soaks through in the space of a night, upon which the whole flake falls down at once. In other parts of the kingdom, chalk generally lies deeper, and they are forced to dig for it at considerable depths, and draw it up in buckets.

Chalk is of two kinds; hard, dry, and firm, or soft and unctuous; both of which are adapted to various purposes. The hard and dry kind is much the properest for burning into lime; but the soft and unctuous chalk is best for using as a manure for lands. Chalk whether burnt into lime or not, is in some cases an excellent manure. Its mode of operating on the soil is explained under the article AGRICULTURE, n° 20, 25, &c.

Pure chalk melts easily with alkali and flint into a transparent colourless glass. With alkaline salts it melts somewhat more difficultly, and with borax somewhat more easily, than with flint or sand. It requires about half its weight of borax, and its whole weight of alkali, to fuse it. Sal mirabile, and sandiver, which do not vitrify at all with the cyrstalline earths, form with half their weight of chalk, the first a yellowish black, the latter a greenish, glass. Nitre, on the other hand, one of the most active fluxes for flint, does not perfectly vitrify with chalk. This earth notably promotes the vitrification of flint; a mixture of the two requiring less alkali than either of them separately. If glass made from flint and alkali is fur-

Chalk.

ther saturated with the flint, so as to be incapable of bearing any further addition of that earth without becoming opaque and milky, it will still in a strong fire take up a considerable proportion, one-third or one-fourth of its weight, of chalk, without injury to its transparency; hence chalk is sometimes made use of in compositions for glass, as a part of the salt may then be spared. Chalk likewise has a great effect in melting the stony matters intermixed with metallic ores, and hence might be of use in smelting ores; as indeed limestone is used for that purpose. But it is remarkable, that chalk, when deprived of its fixed air, and converted into limestone, loses much of its disposition to vitrify. It is then found to melt very difficultly and imperfectly, and to render the glass opaque and milky.

Chalk readily imbibes water; and hence masses of it are employed for drying precipitates, lakes, earthy powders that have been levigated with water, and other moist preparations. Its œconomical uses in cleaning and polishing metalline or glass utensils are well known. In this case it is powdered and washed from any gritty matter it may contain, and is then called *whiting*.—In medicine it is one of the most useful absorbents, and is to be looked upon simply as such. The astringent virtues which some have attributed to it have no foundation, unless in as far as the earth is saturated with an acid, with which it composes a saline concrete manifestly sub-astringent. For the further properties of chalk, see CHEMISTRY, *Index*.

*Black*-CHALK, a name given by painters to a species of earth with which they draw on blue paper, &c. It is found in pieces from two to ten feet long, and from four inches to twenty in breadth, generally flat, but somewhat rising in the middle, and thinner towards the edges, commonly lying in large quantities together. While in the earth, it is moist and flaky: but being dried, it becomes considerably hard and very light; but always breaks in some particular direction; and if attentively examined when fresh broken, appears of a striated texture. To the touch it is soft and smooth, stains very freely, and by virtue of its smoothness makes very neat marks. It is easily reduced into an impalpable soft powder without any diminution of its blackness. In this state it mixes easily with oil into a smooth paste: and being diffused through water, it slowly settles into a black slimy or muddy form; properties which make its use very convenient to the painters both in oil and water colours. It appears to be an earth quite different from common chalk, and rather of the slaty bituminous kind. In the fire it becomes white with a reddish cast, and very friable, retaining its flaky structure, and looking much like the white flaky masses which some sorts of pit-coal leave in burning. Neither the chalk nor these ashes are at all affected by acids.

The colour-shops are supplied with this earth from Italy or Germany; though some parts of England afford substances nearly, if not entirely, of the same quality, and which are found to be equally serviceable both for marking and as black paints. Such particularly is the black earth called *killow*, said by Dr Merret in his *Pinax Rerum Britannicanum* to be found in Lancashire; and by Mr Da Costa, in his history of fossils, to be plentiful near the top of Cay-Avon, an high hill in Merionethshire.

Chalk
Challenge.

*Red*-CHALK, an earth much used by painters and artificers, and common in the colour-shops. It is properly an indurated clayey ochre; and is dug in Germany, Italy, Spain, and France, but in greatest quantity in Flanders. It is of a fine, even, and firm texture; very heavy, and very hard; of a pale red on the outside, but of a deep dusky chocolate colour within. It adheres firmly to the tongue, is perfectly insipid to the taste, and makes no effervescence with acids.

CHALK-*Land*. Barley and wheat will succeed very well on the better sort of chalky land, and oats generally do well on any kind of it. The natural produce of this sort of land in weeds, is that sort of small vetch called the *tine-tare*, with poppies, may-weed, &c. Sainfoin and hop-clover will generally succeed tolerably well on these lands; and where they are of the better sort, the great clover will do. The best manure is dung, old rags, and the sheep-dung left after folding them.

CHALK-*Stones*, in medicine, signify the concretions of calcareous matter in the hands and feet of people violently afflicted with the gout. Leeunwenhoek has been at the pains of examining these by the microscope. He divides them into three parts. The first is composed of various small parcels of matter looking like white grains of sand; this is harder and drier, and also whiter than the rest. When examined with large magnifiers, these are found to be composed of oblong particles laid closely and evenly together: though the whole small stones are opapue, these component parts of them are pellucid, and resemble pieces of horse-hair cut short, only that they are somewhat pointed at both ends. These are so extremely thin, that Mr Leeuwenhoek computes that 1000 of them placed together would not amount to the size of one hair of our heads. The whole stones in this harder part of the chalk are not composed of these particles, but there are confusedly thrown in among them some broken parts of other substances, and in a few places some globules of blood and small remains of other juices. The second kind of chalky matter is less hard and less white than the former, and is composed of fragments or irregular parts of those oblong bodies which compose the first or hardest kind, and these are mixed among tough and clear matter, interspersed with the small broken globules of blood discoverable in the former, but in much greater quantity. The third kind appears red to the naked eye; and, when examined with glasses, is found to be a more tough and clammy white matter, in which a great number of globules of blood are interspersed; these give it the red appearance it has.

CHALLENGE, a cartel or invitation to a duel or other combat*. A challenge either by word or letter, or to be the bearer of such a challenge, is punishable by fine and imprisonment on indictment or information.

* See *Duel*.

CHALLENGE, among hunters. When hounds or beagles, at first finding the scent of their game, presently open and cry, they are said to challenge.

CHALLENGE, in the law of England, is an exception made to jurors †; and is either in civil or criminal cases.

† See the art. *Trial*.

I. In

Challenge.

I. In *civil* cases challenges are of two sorts; challenges to the *array*, and challenges to the *poll*.

1. Challenges to the array are at once an exception to the whole panel, in which the jury are arrayed, or set in order by the sheriff in his return; and they may be made upon account of partiality or some default in the sheriff or his under officer who arrayed the panel. Also, though there be no personal objection against the sheriff, yet if he arrays the panel at the nomination, or under the direction of either party, this is good cause of challenge to the array. Formerly, if a lord of parliament had a cause to be tried, and no knight was returned upon the jury, it was a cause of challenge to the array: also by the policy of the ancient law, the jury was to come *de vicineto*, from the neighbourhood of the vill or place where the cause of action was laid in the declaration: and therefore some of the jury were obliged to be returned from the hundred in which such vill lay, and, if none were returned, the array might be challenged from defect of hundreders. For, living in the neighbourhood, these were supposed to know beforehand the characters of the parties and witnesses; and therefore they better knew what credit to give to the facts alleged in evidence. But this convenience was overbalanced by another very natural and almost unavoidable inconvenience; that jurors coming out of the immediate neighbourhood, would be apt to intermix their prejudices and partialities in the trial of right. And this the law was so sensible of, that it for a long time has been gradually relinquishing this practice; the number of necessary hundreders in the whole panel, which in the reign of Edward III. were constantly six, being in the time of Fortescue reduced to four; afterwards by statute 27 Eliz. c. 6. to two; and at length, by statute 4 and 5 Anne, c. 16. it was entirely abolished upon all civil actions, except upon penal statutes; and upon those also by the 24 Geo. II. c. 18. the jury being now only to come *de corpore comitatus*, from the body of the county at large, and not *de vicineto*, or from the particular neighbourhood. The array by the ancient law may also be challenged, if an alien be party to the suit, and, upon a rule obtained by his motion to the court for a jury *de medietate linguæ*, such a one be not returned by the sheriff pursuant to the statute 28 Edward III. c. 13. enforced by 18 Hen. VI. c. 29. which enacts, that where either party is an alien born, the jury shall be one-half denizens and the other aliens (if so many be forthcoming in the place), for the more impartial trial: A privilege indulged to strangers in no other country in the world; but which is as ancient in England as the time of King Ethelred, in whose statute *de monticolis. Walliæ* (then aliens to the crown of England), c. 3. it is ordained, that "duodeni legales homines, quorum sex Walli et sex Angli erunt, Anglis et Wallis jus dicunto."

2. Challenges to the polls, *in capita*, are exceptions to particular jurors; and seem to answer the *recusatio judicis* in the civil and canon laws; by the constitutions of which, a judge might be refused upon any suspicion of partiality. By the laws of England also, in the times of Bracton and Fleta, a judge might be refused for good cause; but now the law is otherwise, and it is held that judges or justices cannot be challenged. For the law will not suppose a possibility of bias or favour in a judge who is already sworn to administer impartial justice, and whose authority greatly depends on that presumption and idea. And, should the fact at any time prove flagrantly such, as the delicacy of the law will not presume beforehand, there is no doubt but that such misbehaviour would draw down a heavy censure from those to whom the judge is accountable for his conduct. But challenges to the polls of the jury (who are judges of fact) are reduced to four heads by Sir Edward Coke: *propter honoris respectum; propter defectum; propter affectum;* and *propter delictum*. 1. *Propter honoris respectum;* as, if a lord of parliament be impanelled on a jury, he may be challenged by either party, or he may challenge himself. 2. *Propter defectum;* as, if a juryman be an alien born, this is defect of birth; if he be a slave or bondman, this is defect of liberty, and he cannot be a *liber et legalis homo*. Under the word *homo* also, though a name common to both sexes, the female is however excluded, *propter defectum sexus*; except when a widow feigns herself with child in order to exclude the next heir, and a supposititious birth is suspected to be intended; then, upon the writ *de ventre inspiciendo*, a jury of women is to be impanelled to try the question whether with child or not. But the principal deficiency is defect of estate sufficient to qualify him to be a juror, which depends upon a variety of statutes*. 3. Jurors may be challenged *propter affectum*, for suspicion of bias or partiality. This may be either a principal challenge, or to the favour. A *principal* challenge is such, where the cause assigned carries with it, *prima facie*, evident marks of suspicion either of malice or favour: as, that a juror is of kin to either party within the ninth degree; that he has an interest in the cause; that there is an action depending between him and the party; that he has taken money for his verdict, &c. which, if true, cannot be over-ruled, for jurors must be *omne exceptione majores*. Challenges *to the favour*, are where the party hath no principal challenge; but objects only some probable circumstances of suspicion, as acquaintance, and the like; the validity of which must be left to the determination of *triors*, whose office is to decide whether the juror be favourable or unfavourable. 4. Challenges *propter delictum*, are for some crime or misdemeanour that affects the juror's credit, and renders him infamous: As for a conviction of treason, felony, perjury, or conspiracy: or if, for some infamous offence, he hath received judgment of the pillory or the like.

*See *Blackstone's Com.* III. 362.

II. In *criminal* cases, challenges may be made either on the part of the king, or on that of the prisoner; and either to the whole array, or to the separate polls, for the very same reasons that they may be in civil causes. For it is here at least as necessary as there, that the sheriff or returning officer be totally indifferent; that, where an alien is indicted, the jury should be *de midietate*, or half foreigners, if so many are found in the place (which does not indeed hold in treasons, aliens being very improper judges of the breach of allegiance; nor yet in the case of Egyptians under the statute 22 Hen. VIII. c. 10.); that on every panel there should be a competent number of hundreders; and that the particular jurors should be *omne exceptione majores*, not liable to objections either *propter honoris respectum*, Challenge, Challon. *spectum, propter defectum, propter affectum*, or *propter delictum*.

Challenges on any of the foregoing accounts are styled challenges *for cause*; which may be without stint in both civil and criminal trials. But in criminal cases, or at least in capital ones, there is, *in favorem vitæ*, allowed to the prisoner an arbitrary and capricious species of challenge to a certain number of jurors, without showing any cause at all; which is called a peremptory challenge: a provision full of that tenderness and humanity to prisoners for which our laws are famous. This is grounded on two reasons: 1. As every one must be sensible what sudden impressions and unaccountable prejudices we are apt to conceive upon the bare looks and gestures of another; and how necessary it is, that a prisoner, when put to defend his life, should have a good opinion of his jury, the want of which might totally disconcert him; the law wills not that he should be tried by any one man against whom he has conceived a prejudice even without being able to assign a reason for such his dislike. 2. Because upon challenges for cause shown, if the reason assigned prove insufficient to set aside the juror, perhaps the bare questioning his indifference may sometimes provoke a resentment; to prevent all ill consequences from which, the prisoner is still at liberty, if he pleases, peremptorily to set him aside.

This privilege of peremptory challenges, though granted to the prisoner, is denied to the king by the statute 33 Edward I. stat. 4. which enacts, that the king shall challenge no jurors without assigning a cause certain to be tried and approved by the court. However, it is held that the king need not assign his cause of challenge till all the panel is gone through, and unless there cannot be a full jury without the persons so challenged. And then, and not sooner the king's counsel must show the cause: otherwise the juror shall be sworn.

The peremptory challenges of the prisoner must, however, have some reasonable boundary; otherwise he might never be tried. This reasonable boundary is settled by the common law to the number of 35; that is, one under the number of three full juries. For the law judges, that 35 are fully sufficient to allow the most timorous man to challenge through mere caprice; and that he who peremptorily challenges a greater number, or three full juries, has no intention to be tried at all. And therefore it deals with one who peremptorily challenges above 35, and will not retract his challenge, as with one who stands mute or refuses his trial; by sentencing him to the *peine forte et dure* in felony, and by attainting him in treason. And so the law stands at this day with regard to treason of any kind. But by statute 22 Hen. VIII. c. 14. (which, with regard to felonies, stands unrepealed), no person arraigned for felony can be admitted to make more than 20 peremptory challenges.

CHALLON-SUR-SAONE, an ancient town of France, in Burgundy, and capital of the Challonnois, with a citadel and bishop's see. It is seated on the river Saone, in E. Long. 5. 7. N. Lat. 46. 47.

*CHALLONS-Sur-Marne*, a large episcopal town of France, in Champagne. It carries on a considerable trade in shalloons, and other woollen stuffs. It is seated between two fine meadows on the rivers Marne, Mau, and Nau, in E. Long. 4. 37. N. Lat 48. 57.

Chaloner. CHALONER, (Sir Thomas) a statesman, soldier, and poet, descended from a good family in Denbigh in Wales, was born at London about the year 1515. Having been educated in both universities, but chiefly at Cambridge, he was introduced at the court of Henry VIII, who sent him abroad in the retinue of Sir Henry Knevet ambassador to Charles V. and he had the honour to attend that monarch on his fatal expedition against Algiers in 1541. Soon after the fleet left that place, he was shipwrecked on the coast of Barbary in a very dark night: and having exhausted his strength by swimming, he chanced to strike his head against a cable, which he had the presence of mind to catch hold of with his teeth; and, with the loss of several of them, was drawn up by it into the ship to which he belonged. Mr Chaloner returned soon after to England, and was appointed first clerk of the council, which office he held during the rest of that reign. On the accession of Edward VI. he became a favourite of the Duke of Somerset, whom he attended to Scotland, and was knighted by that nobleman after the battle of Musselburgh, in 1547. The protector's fall put a stop to Sir Thomas Chaloner's expectations, and involved him in difficulties. During the reign of queen Mary, being a determined protestant, he was in some danger; but having many powerful friends, he had the good fortune to escape. On the accession of queen Elizabeth, he appeared again at court; and was so immediately distinguished by her Majesty, that she appointed him ambassador to the emperor Ferdinand I. being the first ambassador she nominated. His commission was of great importance; and the queen was so well satisfied with his conduct, that, soon after his return, she sent him in the same capacity to Spain: but Sir Thomas was by no means satisfied with this instance of her majesty's confidence: the courts of England and Spain being at this time extremely dissatisfied with each other, he foresaw that his situation would be very disagreeable; and so it proved; but Elizabeth must be obeyed. He embarked for Spain in 1561, and returned to London in 1564, in consequence of a request to his sovereign, in an elegy written in imitation of Ovid. After his return, he resided in a house built by himself in Clerkenwell-close, where he died in the year 1565, and was buried in St Paul's. Sir William Cecil assisted as chief mourner at his funeral.

So various were the talents of Sir Thomas Chaloner, that he excelled in every thing to which he applied himself. He made a considerable figure as a poet. His poetical works were published by William Malim, master of St Paul's school, in 1579. His capital work was that "Of restoring the English republic, in ten books," which he wrote when he was ambassador in Spain. It is remarkable, that this great man, who knew how to transact as well as to write upon the most important affairs of states and kingdoms, could descend to compose a *dictionary for children*, and to translate from the Latin a book *Of the office of Servants*, merely for the utility of the subjects.

CHALONER, (Sir Thomas) the younger, though inconsiderable as an author, deserves to be recorded as a skilful naturalist, in an age wherein natural history was very

very little understood in this or any other country; and particularly as the founder of the alum-works in Yorkshire, which have since proved so exceedingly advantageous to the commerce of Britain. He was the only son of Sir Thomas Chaloner mentioned in the last article, and was born in the year 1559. Being very young at the time of his father's death, the lord treasurer Burleigh taking charge of his education, sent him to St Paul's school, and afterwards to Magdalen college in Oxford, where, like his father, he discovered extraordinary talents for Latin and English poetry. About the year 1580, he made the tour of Europe, and returned to England before 1584; for, in that year, we find him a frequent attendant in the court of queen Elizabeth. About this time he married the daughter of Sir William Fleetwood, recorder of London. In 1591 he was knighted; and, some time after, discovered the alum-mines on his estate at Gisborough, near the river Tees in Yorkshire (A)

Towards the latter end of the queen's reign, Sir Thomas visited Scotland; and returning to England in the retinue of king James I. found such favour in the sight of his majesty, that he was immediately appointed governor to prince Henry, whom he constantly attended, and, when his royal pupil visited Oxford, was honoured with the degree of master of arts. How he was employed after the death of the prince is not known. Some years before that event, he married a second wife, the daughter of Mr William Blount of London, by whom he had some children. He died in the year 1615, and was buried at Chiswick in Middlesex. His eldest son William was created a baronet in the 18th of James *anno* 1620. The title was extinct in 1681. He wrote, 1. Dedication to Lord Burleigh of his father's poetical works, dated 1579. 2. The virtue of nitre, wherein is declared the sundry cures by the same effected. Lond. 1584, 4to.

CHALYBEAT, in medicine, an appellation given to any liquid, as wine or water, impregnated with particles of iron or steel. See MINERAL WATERS.

CHALYBES, (anc. geog.) an ancient people of the Hither Asia. Their situation is differently assigned; Strabo placing them in Paphlagonia, to the east of Synope; Apollonius Rhodus and Stephanus, on the east of the Thermodon, in Pontus; called *Halizones* by Homer. They either gave their name to, or took it from, their iron manufactures, (Xenophon, Val. Flaccus), their only support, their soil being barren and ungrateful, (Dionysius Periegetes).

CHAM, or KHAN, the title given to the sovereign princes of Tartary.

The word, in the Persian, signifies *mighty lord*; in the Scalvonic, *emperor*. Sperlingius, in his Dissertation on the Danish term of *Majesty, koning, king*, thinks the Tartarian *cham* may be well derived from it; adding, that in the north they say *kan, konnen, konge, konning*, &c. The term *cham* is also applied, among the Persians, to the great lords of the court, and the governors of provinces.



CHAM, in geography, a town of the Bavarian palatinate, situated on a river of the same name, about 25 miles north-east of Ratisbon; E. Long. 13. N. Lat. 49. 15.

CHAMA, in zoology, a genus of shell-fish belonging to the order of vermes testaceæ. The shell is thick, and has two valves; it is an animal of the oyster kind. Linnæus enumerates 14 species, principally distinguished by the figure of their shells.

CHAMADE, in war, a certain beat of a drum, or sound of a trumpet, which is given the enemy as a signal to inform them of some proposition to be made to the commander, either to capitulate, to have leave to bury their dead, make a truce, or the like.—Menage derives the word from the Italian *chiamata*, of *clamare* to "cry."

CHAMÆDRYS, in botany. See VERONICA.

CHAMÆLEON, in zoology, the trivial name of a species of LACERTA.

CHAMÆPITYS, in botany. See TEUCRIUM.

CHAMÆROPS, in botany: a genus of the natural order of palmæ. The hermaphrodite calyx is tripartite; the corolla tripetalous; there are six stamina, three pistils, and three monospermous plums. The male, in a distinct plant, the same as the hermaphrodite. There are two species, the most remarkable of which is the glabra, a native of the West-Indies, and warm parts of America, also of the corresponding latitudes of Asia and Africa. It never rises with a tall stem; but when the plants are old, their leaves are five or six feet long, and upwards of two feet broad; these spread open like a fan, having many foldings, and at the top are deeply divided like the fingers of a hand. This plant the Americans call *thatch*, from the use to which the leaves are applied.—Under the name of palmetto, however, Mr Adanson describes a species of palm which grows naturally at Senegal, whose trunk rises from 50 to 60 feet in height: from the upper end of the trunk issues a bundle of leaves, which, in turning off, form a round head; each leaf represents a fan of five or six feet in expansion, supported by a tail of the same length. Of these trees, some produce male flowers, which are consequently barren; other are female, and loaded with fruit, which succeed each other uninterruptedly almost the whole year round. The fruit of the large palmettos, Mr Adanson affirms to be of the bigness of an ordinary melon, but rounder: it is inveloped in two skins as tough as leather, and as thick as strong parchment; within the fruit is yellowish, and full of filaments fastened to three large kernels in the middle. The negroes are very fond of this fruit, which,



(A) Sir Thomas, during his residence in Italy, being particularly fond of natural history, spent some time at Puzzoli, where he was very attentive to the art of producing alum. This attention proved infinitely serviceable to his country, though of no great benefit to himself or his family, his attempt being attended with much difficulty and expence. It was begun about the year 1600, in the reign of queen Elizabeth; but was not brought to any degree of perfection till some time in the reign of Charles I. by the assistance of one Russel a Walloon, and two other workmen brought from the alum-works at Rochelle. By one of the arbitrary acts of Charles, it was then deemed a mine-royal, and granted to Sir Paul Pindar. The long parliament adjudged it a monopoly, and justly restored it to the original proprietors.

which, when baked under the ashes, is said to taste like a quince.

The little palmetto may be easily raised in Britain from seeds brought from America; but, as the plants are tender, they must be constantly kept in a bark-stove.

CHAMANIM, in the Jewish antiquities, is the Hebrew name for that which the Greeks call *Pyreia* or *Pyrateria;* and St Jerom in Leviticus has translated *Simulachra*, in Isaiah, *delubra*. These chamanim were, according to Rabbi Solomon, idols exposed to the sun upon the tops of houses. Abenezra says they were portable chapels or temples made in the form of chariots, in honour of the Sun. What the Greeks call Pyreia, were temples consecrated to the sun and fire, wherein a perpetual fire was kept up. They were built upon eminences; and were large inclosures without covering, where the sun was worshipped. The Guebres, or worshippers of fire, in Persia and the East-Indies, have still these Pyreia. The word *chamanim* is derived from *Chaman*, which signifies to warm, or burn.

CHAMARIM, a word which occurs in several places of the Hebrew bible, and is generally translated the *the priests of the idols*, or the *priests clothed in black*, because *chamar* signifies "black," or "blackness." St Jerom, in the second book of Kings, renders it *aruspices*. In Hosea and Zephania, he translates it *æditui* or church-wardens. But the best commentators are of opinion, that by this word we are to understand the priests of the false gods, and in particular the worshippers of fire; because they were, as they say, dressed in black; or perhaps the Hebrews gave them this name in derision, because, as they were continually employed in taking care about the fuel, and keeping up the fire, they were always as black as smiths or colliers. We find priests, among those of Isis, called *melancphori*, that is to say, that wear black; but whether this may be by reason of their dressing in black, or whether it were because they wore a certain shining black veil in the processions of this goddess, is not certain. *Camar*, in Arabic, signifies the "moon." Isis is the same deity. Grotius thinks the Roman priests, called *camilli*, came from the Hebrew *chamarim*. Those among the heathens who sacrificed to the infernal gods were dressed in black.

CHAMBER, in building, a member of a lodging, or piece of an apartment, ordinarily intended for sleeping in; and called by the Latins *cubiculum*. The word comes from the Latin *camera*; and that, according to *Nicod*, from the Greek *καμαρα*, *vault* or *curve;* the term *chamber* being originally confined to places arched over.

A complete apartment is to consist of a hall, antichamber, *chamber*, and cabinet.

*Privy-Chamber*, in England. Gentlemen of the privy-chamber are servants of the king, who are to wait and attend on him and the queen at court, in their diversions, &c. Their number is forty-eight, under the lord-chamberlain, twelve of whom are in quarterly waiting, and tw of these lie in the privy-chamber.

In the absence of the lord-chamberlain, or vice-chamberlain, they execute the king's orders: at coronations, two of them personate the dukes of Aquitain and Normandy; and six of them, appointed by the lord-chamberlain, attend ambassadors from crowned heads to their audiences, and in public entries. The gentlemen of the privy chamber were instituted by Henry VII.



Chamber, in policy, the place where certain assemblies are held, also the assemblies themselves. Of these some are established for the administration of justice, others for commercial affairs.

Of the first kind are, 1. Star-chamber, so called, because the roof was painted with stars; the authority, power, and jurisdiction of which, are absolutely abolished, by the statute 17 Car. I. 2. Imperial chamber of Spire, the supreme court of judicatory in the empire, erected by Maximilian I. This chamber has a right of judging by appeal; and is the last resort of all civil affairs of the states and subjects of the empire, in the same manner as the aulic council of Vienna. Nevertheless it is restrained in several cases: it takes no notice of matrimonial causes, these being left to the pope; nor of criminal causes, which either belong to particular princes or towns in their respective territories, or are cognizable by all the states of the empire in a diet. By the treaty of Osnaburg, in 1648, fifty assessors were appointed for this chamber, whereof 24 were to be Protestants, and 26 Catholics; besides five presidents, two of them Protestants, and the rest Catholics. 3. Chamber of accounts, a sovereign court in France, where accounts are rendered of all the king's revenues, inventories, and avowals thereof registered; oaths of fidelity taken, and other things relating to the finances transacted. There are nine in France, that of Paris is the chief; it registers proclamations, treaties of peace, naturalizations, titles of nobility, &c. All the members wear long black gowns of velvet, of sattin, or damask, according to their places. 4. Ecclesiastical chambers in France, which judge by appeal of differences about collecting the tythes. 5. Chamber of audience, or grand chamber, a jurisdiction in each parliament of France, the counsellors of which are called *jugeurs*, or judges, as those of the chamber of inquests are called *raporteurs*, reporters of processes by writing. 6. Chamber of the edict, or miparty, a court established by virtue of the edict of pacification in favour of those of the reformed religion. This chamber is now suppressed. 7. Apostolical chamber of Rome, that wherein affairs relating to the revenues of the church and the pope are transacted. This council consists of the cardinal-camerlingo, the governor of the rota, a treasurer, an auditor, a president, one advocate-general, a solicitor-general, a commissary, and 12 clerks. 8. Chamber of London, an apartment in Guildhall, where the city money is deposited.

Of the last sort are, the chambers of commerce; the chambers of assurance; and the royal or syndical chamber of booksellers in France.

1. The chamber of commerce is an assembly of merchants and traders, where the affairs relating to trade are treated of. There are several established in most of the chief cities of France; and in Britain there have lately been chambers of this kind erected, particularly in London, Edinburgh, and Glasgow.— 2. Chamber of assurance in France, denotes a society of merchants and others for carrying on the business of insuring: but in Holland, it signifies a court of justice, where causes relating to insurance are tried.

3. Chamber of booksellers in Paris, an assembly consisting of a syndic and assistants, elected by four delegates from the printers, and twelve from the booksellers, to visit the books imported from abroad, and to search the houses and sellers of marble paper, printsellers, and dealers in printed paper for hangings, who are prohibited from keeping any letters proper for printing books. In the visitation of books, which ought to be performed by three persons at least from among the syndic and assistants, all libels against the honour of God and the welfare of the state, and all books printed either within or without the kingdom in breach of their regulations and privileges, are stopt, even with the merchandises that may happen to be in the bales with such libels or other prohibited books. The days appointed for this chamber to meet, are Tuesdays and Fridays, at two o'clock in the afternoon.

CHAMBER, in military affairs. 1. Powder-chamber, or bomb-chamber; a place sunk under ground for holding the powder, or bombs, where they may be out of danger, and secured from the rain. 2. Chamber of a mine; the place, most commonly of a cubical form, where the powder is confined. 3. Chamber of a mortar; that part of the chase, much narrower than the rest of the cylinder, where the powder lies. It is of different forms; sometimes like a reversed cone; sometimes globular, with a neck for its communication with the cylinder, whence it is called a bottled chamber; but most commonly cylindrical, that being the form which is found by experience to carry the ball to the greatest distance.

CHAMBERLAIN, an officer charged with the management and direction of a chamber. See CHAMBER, *in policy*.

There are almost as many kinds of chamberlains as chambers, the principal whereof are as follows.

*Lord CHAMBERLAIN of Great-Britain*, the sixth great officer of the crown; to whom belongs livery and lodging in the king's court; and there are certain fees due to him from each archbishop or bishop when they perform their homage to the king, and from all peers at their creation, or doing their homage. At the coronation of every king, he is to have forty ells of crimson velvet for his own robes. This officer on the coronation-day, is to bring the king his shirt, coif, and wearing clothes; and after the king is dressed, he claims his bed, and all the furniture of his chamber, for his fees: he also carries, at the coronation, the coif, gloves, and linen, to be used by the king on that occasion, also the sword and scabbard, the gold to be offered by the king, and the robes-royal and crown: he dresses and undresses the king on that day, waits on him before and after dinner, &c. To this officer belongs the care of providing all things in the house of lords, in the time of parliament; to him also belongs the government of the palace of Westminster: he disposes likewise of the sword of state, to be carried before the king, to what lord he pleases.

The great chamberlain of Scotland was ranked by King Malcom as the third great officer of the crown, and was called *Camerarius Domini Regis*. Before there was a treasurer appointed, it was his duty to collect the revenue of the crown, and he disbursed the money necessary for the king's expences, and the maintenance of the king's household. From the time that a treasurer was appointed, his province was limited to the boroughs throughout the kingdom, where he was a sort of justice-general, as he had a power for judging of all crimes committed within the borough, and of the crime of forestalling. He was to hold chamberlain-ayres every year. He was supreme judge; nor could any of his decrees be questioned by any inferior judicatory. His sentences were put in execution by the magistrates of the boroughs. He also regulated the prices of provisions within the borough, and the fees of the workmen in the mint-house. His salary was only L. 200 a-year. The smallness of his salary, and his great powers, had no doubt been the causes of much oppression in this officer, and the chamberlain-ayre was called rather a legal robbery than a court of justice; and when the combined lords seized King James VI. August 24, 1582, and carried him to Ruthven Castle, they issued a proclamation in the king's name, discharging the chamberlain-ayres to be kept. The chamberlain had great fees arising from the profits of escheats, fines, tolls, and customs. This office was granted heritably to the family of Stuart, duke of Lenox; and when their male line failed, king Charles II. conferred it in like manner upon his natural son, whom he created duke of Monmouth, and on his forfeiture it went to the duke of Lenox; but that family surrendered the office to the crown in 1703.



*Lord CHAMBERLAIN of the Household*, an officer who has the oversight and direction of all officers belonging to the king's chambers, except the precinct of the king's bed-chamber.

He has the oversight of the officers of the wardrobe at all his majesty's houses, and of the removing wardrobes, or of beds, tents, revels, music, comedians, hunting, messengers, &c. retained in the king's service. He moreover has the oversight and direction of the serjeant at arms, of all physicians, apothecaries, surgeons, barbers, the king's chaplains, &c. and administers the oath to all officers above stairs.

Other chamberlains are those of the king's court of exchequer, of North-Wales, of Chester, of the city of London, &c. in which cases this officer is generally the receiver of all rents and revenues belonging to the place whereof he is chamberlain.

In the exchequer there are two chamberlains, who keep a controlment of the pells of receipts and exitus, and have certain keys of the treasury, records, &c.

*CHAMBERLAIN of London* keeps the city money, which is laid up in the chamber of London: He also presides over the affairs of masters and apprentices, and makes free of the city, &c.

His office lasts only a year; but the custom usually obtains to re-chuse the same person, unless charged with any misdemeanour in his office.

CHAMBERLAYNE, (Edward) descended from an ancient family, was born in Gloucestershire 1616, and made the tour of Europe during the distractions of the civil war. After the restoration he went as secretary with the earl of Carlisle, who carried the order of the Garter to the king of Sweden; was appointed tutor to the duke of Grafton, natural son of Charles II. and was afterwards pitched on to instruct prince George of Denmark in the English tongue. He died in 1703, and was buried in a vault in Chelsea church-yard: his monumental inscription mentions six books of his writing; and that he was desirous of doing service to posterity, that he ordered some copies of his books to be covered with wax, and buried with him. That work by which he is best known, is his *Angliæ Notitiæ*, or *the present state of England*, which has been often since printed.

CHAMBERLAYNE, (John) son to the author of "*The Present State of England*," and continuator of that useful work, was admitted into Trinity College, Oxford, 1685; but it doth not appear that he took any degree. Beside the *Continuation* just mentioned, he was author of "Dissertations historical, critical, theological, and moral, on the most memorable events of the Old and New Testaments, with Chronological Tables;" one vol. folio; and translated a variety of works from the French, Dutch, and other languages. He likewise was F. R. S. and communicated some pieces, inserted in the Philosophical Transactions. It was said of him that he understood sixteen languages; but it is certain that he was master of the Greek, Latin, French, High and Low Dutch, Portuguese, and Italian. Though he was qualified for employment, he had none but that of Gentleman-Usher to George Prince of Denmark. After a useful and well-spent life, he died in the year 1724. He was a very pious and good man, and earnest in promoting the advancement of religion, and the interest of true Christianity; for which purpose he kept a large correspondence abroad.

CHAMBERRY, a considerable and populous town of Italy, in Savoy, with a castle. It is capital of the duchy, and well built, but has no fortifications. It is watered by seven streams, which have their sources in St Martin's-hill, and run through several of the streets. There are piazzas under most part of the houses, where people may walk dry in the worst weather. It hath large and handsome suburbs; and in the centre of the town is the royal palace. The parliament meet here, which is composed of four presidents, and a pretty large number of senators, being the supreme tribunal of the whole duchy. The principal church is St Leger, and the Jesuits college is the most magnificent of all the monasteries. E. Long. 5. 50. N. Lat. 45. 35.

CHAMBERS, (David) a Scots historian, priest, and lawyer, was born in the shire of Ross, about the year 1530, and educated in the university of Aberdeen. From thence he went to France and Italy, where he continued some time, particularly at Boulogne, where, in 1556, he was a pupil of Marianus Sozenus.

After his return to Scotland, he was appointed, by queen Mary, parson of Suddy and chancellor of Ross. He was soon after employed in digesting the laws of Scotland, and was principally concerned in publishing the acts of parliament of that kingdom by authority in 1566. He was also appointed one of the lords of session, and continued her majesty's faithful servant till her declining fortune obliged her adherents to seek for refuge in other kingdoms. Chambers went first to Spain, where he was graciously received by king Philip; and thence travelled to Paris, where he was no less kindly received by Charles IX. of that kingdom, to whom, in 1572, he presented his history of Scotland, *&c.* He died at Paris in the year 1592, much regretted (says Mackenzie) by all who knew him. His writings were chiefly calculated to assist his royal mistress, and to extol the wisdom of the Scots nation.

CHAMBERS, (Ephraim) author of the scientific Dictionary which goes under his name, was born at Milton, in the county of Westmoreland. His parents were dissenters of the Presbyterian persuasion; and his education no other than that common one which is intended to qualify a youth for trade and commerce. When he became of a proper age, he was put apprentice to Mr Senex the globe-maker, a business which is connected with literature, and especially with astronomy and geography. It was during Mr Chambers's residence with this skilful mechanic, that he contracted that taste for science and learning which accompanied him through life, and directed all his pursuits. It was even at this time that he formed the design of his grand work, the "Cyclopædia;" and some of the first articles of it were written behind the counter. Having conceived the idea of so great an undertaking, he justly concluded that the execution of it would not consist with the avocations of trade; and therefore he quitted Mr Senex, and took chambers at Gray's-Inn, where he chiefly resided during the rest of his days. The first edition of the *Cyclopædia*, which was the result of many years intense application, appeared in 1728, in two vols. fol. It was published by subscription, the price being 4l. 4s. and the list of subscribers was very respectable. The dedication, which was to the king, is dated October 15, 1727. The reputation that Mr Chambers acquired by his execution of this undertaking, procured him the honour of being elected F. R. S. Nov. 6, 1729. In less than ten years time a second edition became necessary; which accordingly was printed, with corrections and additions, in 1738; and was followed by a third the very next year.

Although the Cyclopædia was the grand business of Mr Chambers's life, and may be regarded as almost the sole foundation of his fame, his attention was not wholly confined to this undertaking. He was concerned in a periodical publication intitled, "The Literary Magazine," which was begun in 1735. In this work he wrote a variety of articles, and particularly a review of Morgan's "Moral Philosopher." He was engaged, likewise, in conjunction with Mr John Martyn, F. R. S. and professor of botany at Cambridge, in preparing for the press a translation and abridgement of the "Philosophical History and Memoirs of the Royal Academy of Sciences at Paris, or an Abridgment of all the Papers relating to Natural Philosophy which have been published by the Members of that illustrious Society." This undertaking, when completed was comprised in five volumes 8vo. which did not appear till 1742, some time after our author's decease, when they were published in the joint names of Mr Martyn and Mr Chambers. Mr Martyn, in a subsequent publication, hath passed a severe censure, upon the share which his fellow-labourer had in the abridgement of the Parisian papers. The only work besides, that we find ascribed to Mr Chambers, is a translation of the *Jesuit's Perspective*, from the French; which was printed in 4to, and hath gone through several editions. Mr Chambers's close and unremitting attention to his studies at length impaired his health

health, and obliged him occasionally to take a lodging at Canonbury-house, Islington. This not having greatly contributed to his recovery, he made an excursion to the south of France, but did not reap that benefit from it which he had himself hoped, and his friends wished. Returning to England, he died at Canonbury-house, and was buried at Westminster; where the following inscription, written by himself, is placed on the north side of the cloysters of the Abbey:

Multis pervulgatus,
Paucis notus;
Qui vitam, inter lucem & umbram,
Nec eruditus, nec idiota,
Literis deditus, transegit; sed ut homo
Qui humani nihil a se alienum putat.
Vita simul, & laboribus functus,
Hic requiescere voluit,
EPHRAIM CHAMBERS, R. S. S.
Obiit xv Maii, MDCCXL.

After the author's death, two more editions of his Cyclopædia were published. The proprietors afterwards procured a supplement to be compiled, which extended to two volumes more: And in the year 1778 began to be published in weekly numbers, an edition of both, improved, and incorporated into one alphabet, by Dr Rees, which has been lately completed in four volumes folio, and forms a very valuable work.

CHAMBRE, (Martin Cureau de la) physician in ordinary to the French king, was distinguished by his knowledge in medicine, philosophy, and polite learning. He was born at Mons; and was received into the French academy in 1635, and afterwards into the academy of sciences. He wrote a great number of works, the principal of which are, 1. The characters of the passions. 2. The art of knowing men. 3. On the knowledge of beasts, &c. He died at Paris in 1669.

CHAMELEON. See LACERTA.

CHAMFERING, in architecture, a phrase used for cutting any thing aslope on the under side.

CHAMIER, (Daniel) an eminent protestant divine born in Dauphine. He was many years preacher at Montellimart; from whence he went in 1612 to Montaubon, to be professor of divinity in that city, and was killed by a cannon-ball during the siege in 1621. The most considerable of his works is his *Panstratia Catholica*, or "Wars of the Lord," in four volumes folio; in which he treats very learnedly of the controversies between the Protestants and Roman Catholics.

CHAMOIS, or CHAMOIS-GOAT, in zoology. See CAPRA.

CHAMOMILE. See ANTHEMIS.

CHAMOS, or CHEMOSH, the idol or god of the Moabites.

The name of *chamos* comes from a root which, in Arabic, signifies to *make haste*; for which reason many believe chamos to be the sun, whose precipitate course might well procure it the name of swift or speedy. Others have confounded chamos with the god *Hammon*, adored not only in Libya and Egypt, but also in Arabia, Ethiophia, and the Indies. Macrobius shows that Hammon was the sun; and the horns, with which he was represented, denoted his rays. Calmet is of opinion, that the god Hamonus, and Apollo Chomeus, mentioned by Strabo and Ammianus Marcellinus, was the very same as chamos or the sun. These deities were worshipped in many of the eastern provinces. Some who go upon the resemblance of the Hebrew term *chamos*, to that of the Greek *comos*, have believed chamos to signify the god Bacchus the god of drunkenness, according to the signification of the Greek *comos*. St Jerom, and with him most other interpreters, take Chamos and Peor for the same deity. But it seems that Baal-Peor was the same as Tammuz or Adonis; so that Chamos must be the god whom the heathens call the Sun.


CHAMOUNI, one of the elevated valleys of the Alps situated at the foot of Mount Blanc. See ALPS and BLANC.

The first strangers whom a curiosity to visit the glaciers drew to Chamouni (M. Saussure observes), certainly considered this valley as a den of robbers; for they came armed cap-a-pee, attended with a troop of domestics armed in the same manner: they would not venture into any house; they lived in tents which they had brought along with them; fires were kept burning, and centinels on guard the whole night over. It was in the year 1741 that the celebrated traveller Pocock, and another English gentleman called Wyndham, undertook this interesting journey. It is remembered by the old men of Chamouni, and they still laugh at the fears of the travellers, and at their unnecessary precautions. For 20 or 25 years after this period, the journey was made but seldom, and then chiefly by Englishmen, who lodged with the curate: for when I was there in 1760, and even for four or five year afterwards, there was no habitable house except one or two miserable inns, like those in villages that are little frequented. But now that this expedition has gradually become so fashionable, three large and good inns, which have been successively built, are hardly sufficient to contain the travellers that come during the summer from all quarters.

This concourse of strangers, and the money they leave behind them at Chamouni, have somewhat affected the ancient simplicity of the inhabitants, and even the purity of their manners. Nobody, however, has any thing to fear from them: the most inviolable fidelity is observed with respect to travellers; they are only exposed to a few importunate solicitations, and some small artifices, dictated by the extreme eagerness with which the inhabitants offer their services as guides.

The hope of obtaining this employment brings together round a traveller, almost all the men in every village through which he passes, and makes him believe that there are a great many in the valley; but there are very few at Chamouni in summer. Curiosity, or the hope of making money, draws many to Paris and into Germany: besides, as the shepherds of Chamouni have the reputation of excelling in the making of cheese, they are in great request in the Tarentaise, in the valley of Aoste, and even at greater distances; and they receive there, for four or five months in summer, very considerable wages. Thus the labours of the field devolve almost entirely on the women, even such as in other countries fall solely on the men; as mowing, cutting of wood and threshing: even the animals of the same sex are not spared, for the cows there are yoked in the plough.

Chamouni.

The only labours that belong exclusively to the men are the seeking for rock crystal, and the chase. Happily they are now less employed than formerly in the first of these occupations. I say happily, for many of them perished in this pursuit. The hope of enriching themselves quickly by the discovery of a cavern filled with fine crystals, was so powerful a motive, that they exposed themselves in the search to the most alarming dangers; and hardly a year passed without some of them perishing in the snows, or among the precipices.

The principal indication of the grottos, or crystal ovens, as they are here called, are veins of quartz, which appear on the outside of the rocks of granite, or of the laminated rock. These white veins are seen at a distance, and often at great heights, on vertical and inaccessible places. The adventurers endeavour to arrive at these, either by fabricating a road across the rocks, or by letting themselves down from above suspended by ropes. When they reach the place, they gently strike the rock; and if the stone returns a hollow sound, they endeavour to open it with a hammer, or to blow it up with powder. This is the principal method of searching: but young people, and even children, often go in quest of these crystals over the glaciers, where the rocks have lately fallen down. But whether they consider these mountains as nearly exhausted, or that the quantity of crystal found at Madagascar has too much lowered the price of this fossil, there are now but few people that go in search of it, and perhaps there is not a single person at Chamouni that makes it his only occupation. They go however occasionally, as to a party of pleasure.

But the chase of the Chamois goat, as dangerous, and perhaps more so than the seeking for crystal, still occupies many inhabitants of the mountains, and carries off, in the flower of their age, many men whose lives are most valuable to their families. And when we are informed how this chase is carried on, we will be astonished that a course of life, at once so laborious and perilous, should have irresistible attractions for those who have been accustomed to it.

The Chamois hunter generally sets out in the night, that he may reach by break of day the most elevated pastures where the goats come to feed, before they arrive. As soon as he discovers the place where he hopes to find them, he surveys it with his glass. If he finds none of them there, he proceeds always ascending: whenever he descries any, he endeavours to get above them, either by stealing along some gully, or getting behind some rock or eminence. When he is near enough to distinguish their horns, which is the mark by which he judges of the distance, he rests his piece on a rock, takes his aim with great composure, and rarely misses. This piece is a rifle-barrelled carabine, into which the ball is thrust, and these carabines often contain two charges, though they have but one barrel; the charges are put one above another, and are fired in succession. If he has wounded the chamois, he runs to his prey, and for security he hamstrings it; then he considers his way home: if the road is difficult, he skins the chamois, and leaves the carcase; but, if it is practicable, he throws the animal on his shoulders, and bears him to his village, though at a great distance, and often over frightful precipices: he feeds his family with the flesh, which is excellent, especially when the creature is young, and he dries the skins for sale.

Chamouni.

But if, as is the most common case, the vigilant chamois perceives the approach of the hunter, he immediately takes flight among the glaciers, through the snows, and over the most precipitous rocks. It is particularly difficult to get near these animals when there are several together; for then one of them, while the rest are feeding, stands as a centinel on the point of some rock that commands a view of the avenues leading to the pasture; and as soon as he perceives any object of alarm, he utters a sort of hiss, at which the others instantly gather round him to judge for themselves of the nature of the danger: if it is a wild beast, or a hunter, the most experienced puts himself at the head of the flock; and away they fly, ranged in a line, to the most inaccessible retreats.

It is here that the fatigues of the hunter begin; instigated by his passion for the chase, he is insensible to danger; he passes over snows, without thinking of the horrid precipices they conceal; he intangles himself among the most dangerous paths, and bounds from rock to rock, without knowing how he is to return. Night often surprises him in the midst of his pursuit; but he does not for that reason abandon it; he hopes that the same cause will arrest the flight of the chamois, and that he will next morning overtake them. Thus he passes the night, not at the foot of a tree, like the hunter of the plain; not in a grotto, softly reclined on a bed of moss, but at the foot of a rock, and often on the bare points of shattered fragments, without the smallest shelter. There, all alone, without fire, without light, he draws from his bag a bit of cheese, with a morsel of oaten bread, which make his common food: bread so dry, that he is sometimes obliged to break it between two stones, or with the hatchet he carries with him to cut out steps in the ice. Having thus made his solitary and frugal repast, he puts a stone below his head for a pillow, and goes to sleep, dreaming on the rout which the chamois may have taken. But soon he is awakened by the freshness of the morning; he gets up, benumbed with cold; surveys the precipices which he must traverse in order to overtake his game; drinks a little brandy, of which he is always provided with a small portion, and sets out to encounter new dangers. Hunters sometimes remain in these solitudes for several days together, during which time their families, their unhappy wives in particular, experience a state of the most dreadful anxiety: they dare not go to rest for fear of seeing their husbands appear to them in a dream; for it is a received opinion in the country, that when a man has perished, either in the snow, or on some unknown rock, he appears by night to the person he held most dear, describes the place that proved fatal to him, and requests the performance of the last duties to his corpse.

"After this picture of the life which the chamois hunters lead, could one imagine that this chase would be the object of a passion absolutely unsurmountable? I knew a well-made, handsome man, who had just married a beautiful woman:—'My grandfather, said he to me, lost his life in the chase; so did my father; and I am persuaded, that I too shall die in the same manner: this bag which I carry with me when I hunt I call my grave-cloaths, for I am sure I will

*Voyage dans les Alpes, par M. Saussure, tom. iii.*

Chamouni.

will have no other; yet if you ſhould offer to make my fortune on condition of abandoning the chaſe of the chamois, I could not conſent. I made ſome excurſions on the Alps with this man: his ſtrength and addreſs were aſtoniſhing: but his temerity was greater than his ſtrength; and I have heard, that, two years afterwards, he miſſed a ſtep on the brink of a precipice, and met with the fate he had expected.

"The few who have grown old in this employment bear upon their faces the marks of the life they have led. A ſavage look, ſomething in it haggard and wild, makes them be known in the midſt of a crowd, even when they are not in their hunting dreſs. And undoubtedly it is this ill look which makes ſome ſuperſtitious peaſants believe that they are ſorcerers, that they have dealings with the devil in their ſolitudes, and that it is he who throws them down the rocks. What then can be the paſſionate inducement to this courſe of life? It is not avarice, at leaſt it is not an avarice conſiſtent with reaſon: the moſt beautiful chamois is never worth more to the perſon that kills it than a dozen of francs, even including the value of its fleſh; and now that the number is ſo much diminiſhed, the time loſt before one can be taken is much more than its value. But it is the very dangers that attend the purſuit, thoſe alternations of hope and fear, the continual agitation and exerciſe which theſe emotions produce in the mind, that inſtigate the hunter: they animate him as they do the gamſter, the warrior, the ſailor, and even to a certain degree, the naturaliſt of the Alps; whoſe life, in ſome meaſure, pretty much reſembles that of the hunter whoſe manners we have deſcribed."

But there is another kind of hunting, which is neither dangerous nor laborious, nor fatal to any one but to the poor animals that are the objects of it.—Theſe are the marmots, animals that inhabit the high mountains; where in ſummer they ſcoop out holes, which they line with hay, and retire to at the beginning of autumn: here they grow torpid with the cold, and remain in a ſort of lethargy, till the warmth of the ſpring returns to quicken their languid blood, and to recal them to life. When it is ſuppoſed that they have retired to their winter abode, and before the ſnow has covered the high paſtures where their holes are made, people go to unharbour them. They are found from 10 to 12 in the ſame hole, heaped upon one another, and buried in the hay. Their ſleep is ſo profound, that the hunter often puts them into his bag, and carries them home without their awaking. The fleſh of the young is good, though it taſtes of oil, and ſmells ſomewhat of muſk; the fat is uſed in the cure of rheumatiſms and pains, being rubbed on the parts affected; but the ſkin is of little value, and is ſold for no more than five or ſix ſols. Notwithſtanding the little benefit they reap from it, the people of Chamouni go in queſt of this animal with great eagerneſs, and its numbers accordingly diminiſh very ſenſibly.

It has been ſaid, that marmots, in order to tranſport the hay into their holes, uſe one of their number laid on his back as a cart; but this is fabulous, for they are ſeen carrying the hay in their mouths. Nor is it for food that they gather it, but for a bed, and in order to ſhut out the cold, and to guard the avenues of their retreat from enemies. When they are taken in autumn, their bowels are quite empty, and even as clean as if they had been waſhed with water; which proves that their torpidity is preceded by a faſt, and even by an evacuation: a wiſe contrivance of Nature for preventing their accumulated fæces from growing putrid, or too dry, in the long lethargy they are expoſed to. They alſo continue a few days after their revival without eating, probably to allow the circulation and digeſtive power to recover their activity. At firſt, leaving their holes, they appear ſtupid and dazzled with the light: they are at this time killed with ſticks, as they do not endeavour to fly, and their bowels are then alſo quite empty. They are not very lean when they awake, but grow more ſo for a few days after they firſt come abroad. Their blood is never congealed, however profound their ſleep may be; for at the time that it is deepeſt, if they are bled, the blood flows as if they were awake.

In theſe countries the period is ſo ſhort between the diſſolution of the ſnow and its return, that grain has hardly time to come to maturity. Mr Saſſure mentions a very uſeful and ingenious practice, invented by mountaineers of the Argentiere, for enlarging this period. "I obſerved (ſays he), in the middle of the valley, ſeveral large ſpaces where the ſurface of the ſnow exhibited a ſingular appearance, ſomewhat reſembling a piece of white cloth ſpotted with black. While I was endeavouring to divine the cauſe of this phenomenon, I diſcovered ſeveral women walking with meaſured pace, and ſowing ſomething in handfuls that was black; and which being ſcattered, regularly diverging, on the ſurface of the ſnow, formed that ſpotted appearance that I had been admiring. I could not conceive what ſeed ſhould be ſown on ſnow ſix feet deep; but my guide, aſtoniſhed at my ignorance, informed me, that it was black earth ſpread upon the ſnow to accelerate its melting; and thus to anticipate, by a fortnight or three weeks, the time of labouring the fields and ſowing. I was ſtruck with the elegant ſimplicity of a practice ſo uſeful, the effects of which I already ſaw very evidently in places which had not been thus treated above three days.

"As to the inhabitants of Chamouni, the men, like thoſe of moſt high valleys, are neither well-made nor tall: but they are nervous and ſtrong, as are alſo the women. They do not attain to a great age; men of 80 are very rare. Inflammatory diſeaſes are the moſt fatal to them; proceeding, no doubt, from obſtructed perſpiration, to which the inconſtant temperature of the climate expoſes them.

"They are in general honeſt, faithful, and diligent in the practice of religious duties. It would, for inſtance, be in vain to perſuade them to go any where on a holiday before hearing maſs. They are economical, but charitable. There are among them neither hoſpitals nor foundations for the poor; but orphans and old people, who have no means of ſubſiſtence, are entertained by every inhabitant of a pariſh in his turn. If a man is prevented by age or infirmities from taking charge of his affairs, his neighbours join among themſelves and do it for him.

"Their mind is active and lively, their temper gay, with an inclination to raillery: they obſerve, with ſingular acuteneſs, the ridiculous in ſtrangers, and turn it it into a fund of very facetious merriment among themselves; yet they are capable of serious thinking: many of them have attacked me on religious and metaphysical subjects; not as professing a different faith from theirs, but on general questions, which showed they had ideas independent of those they were taught."

CHAMPAGNE, a considerable province of France, about 162 miles in length, and 112 in breadth, bounded on the north by Hainhalt and Luxemburg, on the east by Lorrain and the Franche-Comté, on the south by Burgundy, and on the west by the isle of France and Soissonnois. It has a great number of rivers, the principal of which are the Meuse, the Seine, the Marne, the Aube, and the Aine. Its principal trade consists in excellent wine, all sorts of corn, linen cloth, woollen stuffs, cattle, and sheep. It is also divided into the higher and lower, and Troys is the capital town. Its sub-divisions are Champagne Proper, and Rhemois, the Retelois, the Pertois, the Vallage, Basigni, the Senonois, and the Brie Champenois.

*CHAMPAGNE Proper*, is one of the eight parts of Champagne, which comprehends the towns of Troys, Chalons, St Menehold, Eperney, and Vertus.

CHAMPAIN, or *Point CHAMPAIN*, in heraldry, a mark of dishonour in the coat of arms of him who kills a prisoner of war after he has cried quarter.

CHAMPERTRY, in law, a species of MAINTENANCE, and punished in the same manner; being a bargain with the plaintiff or defendant *campum partire*, "to divide the land," or other matter sued for between them, if they prevail at law; whereupon the champertror is to carry on the party's suit at his own expence. Thus *Champart*, in the French law, signifies a similar division of profits, being a part of the crop annually due to the landlord by bargain or custom. In our sense of the word, it signifies the purchasing of a suit, or right of suing; a practice so much abhorred by our law, that it is one main reason why a *chose* in action, or thing of which one hath the right but not the possession, is not assignable in common law; because no man should purchase any pretence to sue in another's right. These pests of civil society, that are perpetually endeavouring to disturb the repose of their neighbours, and officiously interfering in other mens quarrels, even at the hazard of their own fortunes, were severely animadverted on by the Roman law; and were punished by the forfeiture of a third part of their goods and perpetual infamy. Hitherto also must be referred the provision of the statue 32 Henry VIII. c. 9. that no one shall sell or purchase any pretended right or title to land, unless the vender hath received the profits thereof for one whole year before such grant, or hath been in actual possession of the land, or of the reversion or remainder; on pain that both purchaser and vender shall each forfeit the value of such land to the king and the prosecutor.

CHAMPION, a person who undertakes a combat in the place or quarrel of another; and sometimes the word is used for him who fights in his own cause.

It appears that champions, in the just sense of the word, were persons who fought instead of those that, by custom, were obliged to accept the duel, but had a just excuse for dispensing with it, as being too old, infirm, or being ecclesiastics, and the like. Such causes as could not be decided by the course of common law, were often tried by single combat; and he who had the good fortune to conquer, was always reputed to have justice on his side. See the article BATTEL.



*CHAMPION of the King, (campio regis)*, is an ancient officer, whose office is, at the coronation of British kings, when the king is at dinner, to ride armed *cap-a-pee*, into Westminster-Hall, and by the proclamation of an herald make a challenge, "That if any man shall deny the king's title to the crown, he is there ready to defend it in single combat, *&c.*" which being done, the king drinks to him, and sends him a gilt cup with a cover full of wine, which the champion drinks, and hath the cup for his fee. This office, at the coronation of king Richard II. when Baldwin Fréville exhibited his petition for it, was adjudged from him to his competitor Sir John Dymocke (both claiming from Marmion), and hath continued ever since in the family of the Dymockes; who hold the manor of Sinvelsby in Lincolnshire, hereditary from the Marmions by grand serjeantry, *viz.* that the lord thereof shall be the king's champion as aforesaid. Accordingly Sir Edward Dymocke performed this office at the coronation of king Charles II. a person of the name of Dymocke performed at the coronation of his present majesty George the third.

CHAMPLAIN, (Samuel de) a celebrated French navigator, the founder of the colony of New France, or Canada. He built Quebec; and was the first governor of the colony in 1603. Died after 1649. See QUEBEC.

CHANANAEI, (anc. geog.) the name of the ancient inhabitants of Canaan in general, descendants of Canaan; but peculiarly appropriated to some one branch; though uncertain which branch or son of Canaan it was, or how it happened that they preferred the common gentilitious name to one more appropriated as descendants of one of the sons of Canaan: unless from their course of life, as being in the mercantile way, the import of the name *Canaan*; and for which their situation was greatly adapted, they living on the sea and about Jordan, and thus occupying the greater part of the Land of Promise.

CHANCE, a term we apply to events, to denote that they happen without any necessary or foreknown cause. See CAUSE.

Our aim is, to ascribe those things to *chance*, which are not necessarily produced as the natural effects of any proper cause: but our ignorance and precipitancy lead us to attribute effects to *chance*, which have a necessary and determinate cause.

When we say a thing happens *by chance*, we really mean no more than that its cause is unknown to us: not, as some vainly imagine, that *chance* itself can be the cause of any thing.

The case of the painter, who, unable to express the foam at the mouth of a horse he had painted, threw his sponge in despair at the piece, and, *by chance*, did that which he could not before do by design, is an eminent instance of the force of *chance*: yet, it is obvious, all we here mean by *chance*, is, that the painter was not aware of the effect; or that he did not throw the sponge with such a view: not but that he actually did every thing necessary to produce the effect; insomuch, that, considering the direction wherein

wherein he threw his ſponge, together with its form, ſpecific gravity, the colours wherewith it was ſmeared, and the diſtance of the hand from the piece, it was impoſſible, on the preſent ſyſtem of things, the effect ſhould not follow.

*Chance* is frequently perſonified, and erected into a chimerical being, whom we conceive as acting arbitrarily, and producing all the effects whoſe real cauſes do not appear to us: in which ſenſe the word coincides with the *τυχη*, *fortuna*, of the ancients.

CHANCE is alſo uſed for the manner of deciding things, the conduct or direction whereof is left at large, and not reducible to any determinate rules or meaſures; or where there is no ground for preference: as at cards, dice, lotteries, &c.

*For the Laws of* CHANCE, *or the proportion of Hazard in Gaming*, ſee GAME.

The ancient *ſortilege*, or *chance*, M. Placette obſerves, was inſtituted by God himſelf; and in the Old Teſtament we find ſeveral ſtanding laws and expreſs commands which preſcribed its uſe on certain occaſions: hence the Scripture ſays, "The *lot*, or *chance*, fell on Matthias," when it was in queſtion who ſhould fill Judas's place in the apoſtolate.

Hence alſo aroſe the *ſortes ſanctorum;* or method of determining things, among the ancient Chriſtians, by opening ſome of the ſacred books, and pitching on the firſt verſe they caſt their eye on, as a ſure prognoſtic of what was to befal them. The *ſortes Homericæ, Virgilianæ, Prœneſtinæ*, &c. uſed by the heathens, were with the ſame view, and in the ſame manner. See SORTES.

St Auguſtin ſeems to approve of this method of determining things future, and owns that he had practiſed it himſelf; grounded on this ſuppoſition, that God preſides over *chance;* and on Prov. xvi. 33.

Many among the modern divines hold *chance* to be conducted in a particular manner by Providence; and eſteem it an extraordinary way which God uſes to declare his will, and a kind of immediate revelation.

CHANCE-*Medley*, in law, is where one is doing a lawful act, and a perſon is killed by chance thereby; for if the act be unlawful, it is felony. If a perſon caſt, not intending harm, a ſtone, which happens to hit one, whereof he dies; or ſhoots an arrow in an highway, and another that paſſeth by is killed therewith; or if a workman, in throwing down rubbiſh from a houſe after warning to take care, kills a perſon; or a ſchoolmaſter in correcting his ſcholar, a maſter his ſervant, or an officer in whipping a criminal in a reaſonable manner, happens to occaſion his death; it is chance-medley and miſadventure. But if a man throw ſtones in a highway where perſons uſually paſs; or ſhoot an arrow, &c. in a market-place among a great many people; or if a workman caſt down rubbiſh from a houſe in cities and towns where people are continually paſſing; or a ſchoolmaſter, &c. correct his ſervant or ſcholar, &c. exceeding the bounds of moderation; it is manſlaughter: and if with an improper inſtrument of correction, as with a ſword or iron bar, or by kicking, ſtamping, &c. in a cruel manner, it is murder. If a man whips his horſe in a ſtreet to make him gallop, and the horſe runs over a child and kills it, it is manſlaughter: but if another whips the horſe, it is manſlaughter in him, and chance-medley in the rider. And if two are fighting, and a third perſon coming to part them is killed by one of them without any evil intent, yet this is murder in him, and not manſlaughter by chance-medley or miſadventure. In chance-medley, the offender forfeits his goods; but hath a pardon of courſe.



CHANCEL, is properly that part of the choir of a church, between the altar or communion-table and the baluſtrade or rail that incloſes it, where the miniſter is placed at the celebration of the communion. The word comes from the Latin *cancellus*, which in the lower Latin is uſed in the ſame ſenſe, from *cancelli*, "lattices or croſs bars," wherewith the chancels were anciently encompaſſed, as they now are with rails. The right of a ſeat and a ſepulchre in the chancels is one of the privileges of founders.

CHANCELLOR, was at firſt only a chief notary or ſcribe under the emperors; and was called *cancellarius*, becauſe he ſat behind a lattice (in Latin *cancellus*) to avoid being crowded by the people: though ſome derive the word from *cancellare*, "to cancel" (See CHANCERY). This office was afterwards inveſted with ſeveral judicial powers, and a general ſuperintendency over the reſt of the officers of the prince. From the Roman empire it paſſed to the Roman church, ever emulous of imperial ſtate: and hence every biſhop has to this day his chancellor, the principal judge of his conſiſtory. And when the modern kingdoms of Europe were eſtabliſhed upon the ruins of the empire, almoſt every ſtate preſerved its chancellor with different juriſdictions and dignities, according to their different conſtitutions. But in all of them he ſeems to have had the ſupervision of all charters, letters, and ſuch other public inſtruments of the crown as were authenticated in the moſt ſolemn manner: and therefore, when ſeals came in uſe, he had always the cuſtody of the king's great ſeal.

*Lord High* CHANCELLOR *of Great Britain*, or *Lord Keeper of the Great Seal*, is the higheſt honour of the long robe, being created by the mere delivery of the king's great ſeal into his cuſtody; whereby he becomes, without writ or patent, an officer of the greateſt weight and power of any now ſubſiſting in that kingdom. He is a privy counſellor by his office; and, according to Lord Chancellor Elleſmere, prolocutor of the houſe of lords by preſcription. To him belongs the appointment of all the juſtices of the peace throughout the kingdom. Being in former times commonly an eccleſiaſtic (for none elſe were then capable of an office ſo converſant in writing), and preſiding over the royal chapel, he became keeper of the king's conſcience; viſitor, in right of the king, of all hoſpitals and colleges of the king's foundation; and patron of all the king's livings under the value of L. 20 *per annum* in the king's books. He is the general guardian of all infants, ideots, and lunatics; and has the general ſuperintendance of all charitable uſes in the kingdom. And all this over and above the vaſt extenſive juriſdiction which he exerciſes in his judicial capacity in the court of chancery. He takes precedence of every temporal lord except the royal family, and of all others except the archbiſhop of Canterbury. See CHANCERY.

CHANCELLOR, in Scotland, was the chief in matters of juſtice. In the laws of King Malcolm II. he is

Chancellor. placed before all other officers; and from these it appears that he had the principal direction of the chancery, or Chancellary as it is called, which is his proper office. He had the custody of the king's seal; and he was the king's most intimate counsellor, as appears by an old law cited by Sir James Balfour: "The chancellar sall at al tymes assist the king, in giving him counsail mair secretly nor the rest of the nobility, to quhais ordinances all officiaris, als well of the realme as the kingis hous, sould answer and obey. The chancellar sall be ludgit neir unto the kingis grace, for keiping of his bodie, and the seill; and that he may be readie baith day and nicht at the kingis command." By having the custody of the great seal, he had an opportunity of examining the king's grants and other deeds which were to pass under it, and to cancel them if they appeared against law, and were obtained surreptitiously or by false suggestions.

King James VI. ordained the chancellor to have the first place and rank in the nation, *ratione officii;* by virtue whereof he presided in the parliament, and in all courts of judicature. After the restoration of King Charles II. by a particular declaratory law, parliament first, the lord chancellor was declared, by virtue and right of his office, president in all the meetings of parliament, or other public judicatures of the kingdom. Although this act was made to declare the chancellor president of the exchequer as well as other courts, yet in 1663 the king declared the treasurer to be president of that court.

The office of lord chancellor of Scotland was abolished by the Union, their being no farther use for the judicial part of this office; and, to answer all the other parts of the chancellor's office, a lord keeper of the great seal was erected, with a salary of L. 3000 a-year.

*Chancellor of a Cathedral*, an officer that hears lessons and lectures read in the church, either by himself or his vicar; to correct and set right the reader when he reads amiss; to inspect schools; to hear causes; apply the seal; write and dispatch the letters of the chapter; keep the books; take care that there be frequent preachings, both in the church and out of it, and assign the office of preaching to whom he pleases.

*Chancellor of the Duchy of Lancaster*, an officer appointed chiefly to determine controversies between the king and his tenants of the duchy-land, and otherwise to direct all the king's affairs belonging to that court. See *Duchy-Court*.

*Chancellor of the Exchequer*, an officer who presides in that court, and takes care of the interest of the crown. He is always in commission with the lord-treasurer, for the letting of crown-lands, &c. and has power, with others, to compound for forfeitures of lands upon penal statutes. He has also great authority in managing the royal revenues, and in matters relating to the first-fruits.

*Chancellor of the Order of the Garter, and other Military Orders*, is an officer who seals the commissions and mandates of the chapter and assembly of the knights, keeps the register of their proceedings, and delivers acts thereof under the seal of their order.

*Chancellor of an University*, is he who seals the diplomas, or letters of degrees, provision, &c. given in the university.

The chancellor of Oxford is usually one of the prime nobility, chosen by the students themselves in convocation. He is their chief magistrate; his office is, *durante vita*, to govern the university, preserve and defend its rights and privileges, convoke assemblies, and do justice among the members under his jurisdiction. Chancell. || Chancery.

Under the chancellor is the vice-chancellor, who is chosen annually, being nominated by the chancellor, and elected by the university in convocation. He is always the head of some college, and in holy orders. His proper office is to execute the chancellor's power, to govern the university according to her statutes, to see that officers and students do their duty, that courts be duly called, &c. When he enters upon his office, he chooses four pro-vice-chancellors out of the heads of the colleges, to execute his power in his absence.

The chancellor of Cambridge is also usually one of the prime nobility, and in most respects the same as that in Oxford; only he does not hold his office *durante vita*, but may be elected every three years. Under the chancellor there is a commissary, who holds a court of record for all privileged persons and scholars under the degree of master of arts, where all causes are tried and determined by the civil and statute law, and by the custom of the university.

The vice-chancellor of Cambridge is chosen annually by the senate, out of two persons nominated by the heads of the several colleges and halls.

*Chancellor's Court*. See *University Courts*.

CHANCERON, in natural history, a name given by the French writers to the small caterpillar that eats the corn, and does vast mischief in their granaries. See the article *Corn-Butterfly*.

CHANCERY, the highest court of justice in Britain next to the parliament, and of very ancient institution. It has its name chancery *(cancellaria)* from the judge who presides here, the lord chancellor, or *cancellarius*; who, according to Sir Edward Coke, is so termed *a cancellando*, from cancelling the king's letters patent when granted contrary to law, which is the highest point of his jurisdiction. In chancery there are two distinct tribunals: the one ordinary, being a court of common law; the other extraordinary, being a court of equity.

1. The *ordinary* legal court holds pleas of recognizances acknowledged in the chancery, writs of *scire facias*, for repeal of letters patent, writs of partition, &c. and also of all personal actions by or against any officer of the court. Sometimes a *supersedeas*, or writ of privilege, hath been here granted to discharge a person out of prison; one from hence may have a *habeas corpus* prohibition, &c. in the vacation: and here a *subpœna* may be had to force witnesses to appear in other courts, when they have no power to call them. But, in prosecuting causes, if the parties descend to issue, this court cannot try it by jury; but the lord chancellor delivers the record into the king's bench to be tried there; and after trial had, it is to be remanded into the chancery, and there judgment given: tho' if there be a demurrer in law, it shall be argued in this court. *Blackst. Comment.*

In this court is also kept the *officina justitiæ*; out of which all original writs that pass under the great seal, all commissions of charitable uses, sewers, bankruptcy, idiocy, Chancery. idiocy, lunacy, and the like, do iſſue; and for which it is always open to the ſubject, who may there at any time demand and have, *ex debito juſtitiæ*, any writ that his occaſions may call for. Theſe writs, relating to the buſineſs of the ſubject, and the returns of them, were, according to the ſimplicity of ancient times, originally kept in a hamper, *in hanaperio*; and the others (relating to ſuch matters wherein the crown is mediately or immediately concerned) where preſerved in a little ſack or bag, *in parva baga:* and hence hath ariſen the diſtinction of the *hanaper* office, and the *petty-bag* office, which both belong to the common law-court in chancery.

2. The *extraordinary* court, or court of equity, proceeds by the rules of equity and conſcience; and moderates the rigour of the common law, conſidering the *intention* rather than the *words* of the law. It gives relief for and againſt infants notwithſtanding their minority, and for and againſt married women notwithſtanding their coverture. All frauds and deceits for which there is no redreſs at common law; all breaches of truſt and confidence; and accidents, as to relieve obligors, mortgagers, &c. againſt penalties and forfeitures, where the intent was to pay the debt, are here remedied: for in chancery, a forfeiture, &c. ſhall not bind, where a thing may be done after or compenſation made for it. Alſo this court will give relief againſt the extremity of unreaſonable engagements entered into without conſideration; oblige creditors that are unreaſonable to compound with an unfortunate debtor; and make executors, &c. give ſecurity and pay intereſt for money that is to lie long in their hands. This court may confirm title to lands, though one hath loſt his writings; and render conveyances, defective through miſtake, &c. good and perfect. In chancery, copy-holders may be relieved againſt the ill uſage of their lords; incloſures of lands that are common be decreed; and this court may decree money or lands given to charitable uſes, oblige men to account with each other, &c. But in all caſes where the plaintiff can have his remedy at law, he ought not to be relieved in chancery; and a thing which may be tried by a jury is not triable in this court.

The proceedings in chancery are, firſt to file the bill of complaint, ſigned by ſome counſel, ſetting forth the fraud or injury done, or wrong ſuſtained, and praying relief: after the bill is filed, proceſs of *ſubpœna* iſſues to compel the defendant to appear; and when the defendant appears, he puts in his anſwer to the bill of complaint, if there be no cauſe for the plea to the juriſdiction of the court, in diſability of the perſon, or in bar, &c. Then the plaintiff brings his replication, unleſs he files exceptions againſt the anſwer as inſufficient, referring it to a maſter to report whether it be ſufficient or not; to which report exceptions may alſo be made. The anſwer, replication, rejoinder, &c. being ſettled, and the parties come to iſſue, witneſſes are to be examined upon interrogatories, either in court, or by commiſſion in the country, wherein the parties uſually join; and when the plaintiff and defendant have examined their witneſſes, publication is to be made of the depoſitions, and the cauſe is to be ſet down for hearing; after which follows the decree. But it is now uſual to appeal to the houſe of lords; which appeals are to be ſigned by two noted counſel, and exhibited by way of petition; the petition or appeal is lodged with the clerk of the houſe of lords, and read in the houſe, whereon the appellee is ordered to put in his anſwer, and a day fixed for hearing the cauſe; and after counſel heard, and evidence given on both ſides, the lords will affirm or reverſe the decree of the chancery, and finally determine the cauſe by a majority of votes, &c.

Chandelier | Chandler.

CHANDELIER, in fortification, a kind of moveable parapet, conſiſting of a wooden frame, made of two upright ſtakes, about ſix feet high, with croſs planks between them; ſerving to ſupport faſcines to cover the pioneers.

CHANDERNAGORE, a French ſettlement in the kingdom of Bengal in the Eaſt-Indies. It lies on the river Ganges, two leagues and a half above Calcutta. The diſtrict is hardly a league in circumference, and has the diſadvantage of being ſomewhat expoſed on the weſtern ſide; but its habour is excellent, and the air is as pure as it can be on the banks of the Ganges. Whenever any building is undertaken that requires ſtrength, it muſt here, as well as in all other parts of Bengal, be built upon piles; it being impoſſible to dig three or four feet without coming at water.

CHANDLER, (Mary) diſtinguiſhed by her talent for poetry, was the daughter of a diſſenting miniſter at Bath; and was born at Malmſbury in Wiltſhire, in 1687. She was bred a milliner; but from her childhood had a turn for poetry, and in her riper years applied herſelf to the ſtudy of the poets. Her poems, for which ſhe was complimented by Mr Pope, breathe the ſpirit of piety and philoſophy. She had the misfortune to be deformed, which determined her to live ſingle; though ſhe had great ſweetneſs of countenance, and was ſolicited to marry. She died in 1745, aged 58.

CHANDLER, (Dr Samuel) a learned and reſpectable diſſenting miniſter, deſcended from anceſtors heartily engaged in the cauſe of religious liberty, and ſufferers for the ſake of conſcience and nonconformity; was born at Hungerford in Berks, where his father was a miniſter of conſiderable worth and abilities. Being by his literary turn deſtined to the miniſtry, he was at firſt placed at an academy at Bridgewater, and from thence removed to Glouceſter under Mr Samuel Jones. Among the pupils of Mr Jones were Mr Joſeph Butler, afterwards biſhop of Durham, and Mr Thomas Secker, afterwards archbiſhop of Canterbury. With theſe eminent perſons he contracted a friendſhip that continued to the end of their lives, notwithſtanding the different views by which their conduct was afterwards directed, and the different ſituations in which they were placed.

Mr Chandler having finiſhed his academical ſtudies, began to preach about July 1714; and being ſoon diſtinguiſhed by his talents in the pulpit, he was choſen in 1716 miniſter of the Preſbyterian congregation at Peckham near London, in which ſtation he continued ſome years. Here he entered in the matrimonial ſtate, and began to have an increaſing family, when, by the fatal South-ſea ſcheme of 1720, he unfortunately loſt the whole fortune which he had received with his wife. His circumſtances being thereby embarraſſed, and his income as a miniſter being inadequate to his expences, he engaged in the trade of a bookſeller, and kept a ſhop in the Poultry, London, for about two or three

Chandler.

years, still continuing to discharge the duties of the pastoral office. He also officiated as joint preacher with the learned Dr Lardner of a winter weekly evening lecture at the meeting-house in the Old Jewry, London: in which meeting he was established assistant preacher about the year 1725, and then as the pastor. Here he ministered to the religious improvement of a very respectable congregation for 40 years with the greatest applause; and with what diligence and application he improved the vacancies of time from his pastoral duties, for improving himself and benefiting the world, will appear from his many writings on a variety of important subjects. While he was thus laudably employed, not only the universities of Edinburgh and Aberdeen gave him, without any application, testimonies of their esteem in diplomas, conferring on him the degree of D. D. but he also received offers of preferment from some of the governors of the established church, which he nobly declined. He had likewise the honour of being afterwards elected F. R. and A. SS.

On the death of George II. in 1760, Dr Chandler published a sermon on that event, in which he compared that prince to King David. This gave rise to a pamphlet, which was printed in the year 1761, intitled "The History of the Man after God's own Heart;" wherein the author ventured to exhibit King David as an example of perfidy, lust, and cruelty, fit only to be ranked with a Nero or a Caligula; and complained of the insult that had been offered to the memory of the late British monarch by Dr Chandler's parallel between him and the king of Israel. This attack occasioned Dr Chandler to publish in the following year "A Review of the History of the Man after God's own Heart; in which the Falsehoods and Misrepresentations of the Historian are exposed and corrected." He also prepared for the press a more elaborate work, which was afterwards published in two volumes 8vo, under the following title: "A Critical History of the Life of David: in which the principal Events are ranged in Order of time; the chief Objections of Mr Bayle and others against the Character of this Prince, and the Scripture Account of him, and the Occurrences of his Reign, are examined and refuted; and the Psalms which refer to him explained." As this was the last, it was likewise one of the best, of Dr Chandler's productions. The greatest part of this work was printed off at the time of our author's death, which happened May 8th 1766, aged 73. During the last year of his life, he was visited with frequent returns of a very painful disorder, which he endured with great resignation and Christian fortitude. He was interred in the burying-ground at Bunhill-fields on the 16th of the month; and his funeral was very honourably attended by ministers and other gentlemen. He expressly desired, by his last will, that no delineation of his character might be given in his funeral sermon, which was preached by Dr Amory. He had several children; two sons and a daughter who died before him, and three daughters who survived him; two of whom are yet living, and both married, one of them to the Rev. Dr Harwood.

Dr Chandler was a man of very extensive learning and eminent abilities; his apprehension was quick and his judgment penetrating; he had a warm and vigorous imagination; he was a very instructive and animated preacher; and his talents in the pulpit and as a writer procured him very great and general esteem, not only among the dissenters, but among large numbers of the established church. He was principally instrumental in the establishment of the fund for relieving the widows and orphans of poor Protestant dissenting ministers: the plan of it was first formed by him; and it was by his interest and application to his friends that many of the subscriptions for its support were procured.

Chandler Chang-tong.

In 1768, four volumes of our author's sermons were published by Dr Amory, according to his own directions in his last will; to which was prefixed a neat engraving of him, from an excellent portrait by Mr Chamberlin. He also expressed a desire to have some of his principal pieces reprinted in four volumes 8vo: proposals were accordingly published for that purpose, but did not meet with sufficient encouragement. But in 1777, another work of our author was published in one volume 4to, under the following title: "A Paraphrase and Notes on the Epistles of St Paul to the Galatians and Ephesians, with doctrinal and practical Observations: together with a critical and practical Commentary on the two Epistles of St Paul to the Thessalonians." Dr Chandler also left, in his interleaved Bible, a large number of critical notes, chiefly in Latin, which are now the property of Dr Hippis, Mr Farmer, Dr Price, and Dr Savage, and which have been intended to be published; but the design has not yet been executed. A complete list of Dr Chandler's works is given in the Biographia Britannica, vol. III. p. 435.

CHANG-TONG, a province of China, bounded on the east by Petcheli and part of Honan, on the south by Kiang-nan, on the east by the sea, and on the north by the sea and part of Petcheli. The country is well watered by lakes, streams, and rivers; but is nevertheless liable to suffer from drought, as rain falls here but seldom. The locusts also sometimes make great devastation. However, it abounds greatly in game; and there is perhaps no country where quails, partridges, and pheasants, are sold cheaper, the inhabitants of this province being reckoned the keenest sportsmen in the empire. The province is greatly enriched by the river Yun, called the *Grand Imperial Canal*, through which all the barks bound to Pekin must pass in their way thither. The duties on this canal alone amount to more than L.450,000 annually. The canal itself is greatly admired by European travellers on account of its strong and long dikes, the banks decorated with cut stone, the ingenious mechanism of its locks, and the great number of natural obstacles which have been overcome in the execution of the work.—The province produces silk of the ordinary kind; and, besides this, another from a sort of insect resembling our caterpillar. It is coarser than the ordinary silk, but much stronger and more durable; so that the stuffs made from it have a very extensive sale throughout the empire.

Chang-tong is remarkable for being the birth-place of the celebrated philosopher and lawgiver Confucius. His native city is called *Kio-feou*, where there are several monuments erected in honour of this great man. The province is divided into six districts, which contain six cities of the first class, and 114 of the second and

and third. Along the coast, also, are 15 or 16 villages of cosiderable importance on account of their commerce; there are likewise a number of small islands, most of which have harbours very convenient for the Chinese junks which pass from thence to Corea or Leatong. The most remarkable cities are, 1. Tsi-nan-fou, the capital, which stands south of the river Tsingho or Tsi. It is large and populous; but chiefly celebrated for having been the residence of a long series of kings, whose tombs, rising on the neighbouring mountains, afford a beautiful prospect. 2. Yen-tcheu-fou, the second city of the province, situated between two rivers, and in a mild and temperate climate. Great quantities of gold are said to have been formerly collected in its neighbourhood. 3. Lin-tcin-tcheu, situated on the great canal, is much frequented by ships, and may be called a general magazine for every kind of merchandise. Here is an octagonal tower, divided into eight stories, the walls of which are covered on the outside with porcelain loaded with various figures neatly executed, and encrusted on the inside with variously coloured marble. A staircase, constrncted in the wall, conducts to all the stories, from which there are passages that lead into magnificent galleries ornamented with gilt ballustrades. All the cornices and projections of the tower are furnished with little bells; which, says Mr Grosier, when agitated by the wind, form a very agreeable harmony. In the highest story is an idol of gilt copper, to which the tower is dedicated. In the neighbourhood are some other temples, the architecture of which is exceedingly beautiful.

CHANGER, in England, an officer belonging to the king's mint, who changes money for gold or silver bullion. See MINT.

*Money-CHANGER*, is a banker who deals in the exchange, receipt, and payment, of moneys. See BANKER.

CHANGES, in arithmetic, &c. the permutations or variations of any number of quantities; with regard to their position, order, &c. See COMBINATION.

*To find all the possible CHANGES of any Number of Quantities, or how oft their Order may be varied.*] Suppose two quantities $a$ and $b$. Since they may be either wrote $a\ b$ or $b\ a$, it is evident their *changes* are $2=2.1$. Suppose three quantities $a\ b\ c$: their *changes* will be as in the margin; as is evident by combining $c$ first with $a\ b$, then with $b\ a$; and hence the number of *changes* arises $3.\ 2.\ 1=6$. If the quantities be 4, each may be combined four ways with each order of the other three; whence the number of changes arises $6.\ 4=4.\ 3.\ 2.\ 1.=24$. Whereof, if the number of quantities be supposed $n$, the number of *changes* will be $n.n-1.n-2.n-3.n-4.$ &c. If the same quantity occur twice, the *changes* of two will be found $b\ b$; of three, $b\ a\ b, a\ b\ b, b\ b\ c$; of four, $c\ b\ a\ b, b\ c\ a\ b, b\ a\ b\ c$. And thus the number of *changes* in the first case will be $1=(2.\ 1):\ 2.\ 1$; in the second, $3=(3.\ 2.\ 1):\ 2.\ 1$: in the third, $12=(4.\ 3.\ 2.\ 1):\ 2.\ 1$.

c a b
a c b
a b c
——
c b a
b c a
b a c

If a fifth letter be added, in each series of four quantities, it will beget five *changes*, whence the number of all the *changes* will be $60=(5.\ 4.\ 3.\ 2.)\ 1,:\ 2.\ 1$. Hence if the number of quantities be $n$, the number of *changes* will be $(n.n-1.n-2.n-3.n-4.$ &c.$):\ 2.\ 1$. From these special formulæ may be collected a general one, viz. if $n$ be the number of quantities, and $m$ the number which shows how oft the same quantity occurs; we shall have $(n.n-1.n-2.n-3.n-4.n-5.n-6.n-7.n-8.n-9.$ &c. $: m-1.m-2.m-3.m-4.$ &c.$)$ the series being to be continued, till the continual subtraction of unity from $n$ and $m$ leave 0. After the same manner we may proceed further, till putting $n$ for the number of quantities, and $l, m, r$, &c. for the number that shows how oft any of them is repeated, we arrive at an universal form. $(n.n-1.n-2.n-3.n-4.n-5.n-6.n-7.n-8.$ &c.$):(l.l-1.l-2.l-3.l-4.l-5.$ &c. $m.m-1.m-2.m-3.$ &c. $r.r-1.r-2.r-3.r-4.r-5.$ &c.

Suppose, for instance, $n=6, l=3, r=0$. The number of *changes* will be $(6.\ 5.\ 4.\ 3.\ 2.\ 1.):(3.\ 2.\ 1.\ 3.\ 2.\ 1.)=(6.\ 5.\ 4.):(3.\ 2=2.\ 5.\ 2=20)$.

Hence, suppose thirteen persons at a table, if it be required how oft they may *change* places; we shall find the number $13.\ 12.\ 11.\ 10.\ 9.\ 8.\ 7.\ 6.\ 5.\ 4.\ 3.\ 2.\ 1.=6227020800$.

In this manner may all the possible anagrams of any word be found in all languages, and that without any study: suppose *v. g.* it were required to find the anagrams of the word *amor*, the number of *changes* will be

| | | | | |
|---|---|---|---|---|
| *a* | *o a m* | *r m o a* | *m a r o* | *a r o m* |
| —— | *a o m* | *m r o a* | *m a o r* | *a o r m* |
| *m a* | *a m o* | *m o r a* | —— | *a o m r* |
| *a m* | —— | *m o a r* | *r a o m* | —— |
| —— | *r o m a* | —— | *o r a m* | *r a m o* |
| *o m a* | *o r m a* | *r m a o* | *o a r m* | *a r m o* |
| *m o a* | *o m r a* | *m r a o* | *o a m r* | *a m r o* |
| *m a o* | *o m a r* | | —— | *a m o r* |
| | | | *r a o m* | |

The anagrams therefore of the word *amon*, in the Latin tongue, are *roma, mora, maro, ramo, armo*. See ANAGRAM.

Whether this new method of anagramatizing be like to prove of much service to that art, is left to the poets.

CHANNA, in zoology, the name of a fish caught in great plenty in the Mediterranean, and brought to market in Italy and elsewhere, among the sea-perch, which it so nearly resembles, that it would not be distinguishable from it, but that the sea-perch is bigger, and has only broad transverse lines on its back, whereas the channa has them both transverse and longitudinal. It has a very wide mouth, and its lower jaw is longer than its upper; so that its mouth naturally falls open. Its eyes are small, and its teeth very sharp: its back is of a blackish red: it has several longitudinal lines of a reddish hue, and its tail is marked with reddish spots. There is an observation, that in all the fish of this kind which have been examined by naturalists, there have been found none but females. This is as old as the days of Aristotle. Whether this be true in fact, would require many observations. If it should prove so, the whole seems to end in this, that the channa is no distinct species, but only the female of some other fish. There is another fish not unlike this, called *cannadella*, or rather *channadella*, which at Marseilles is known by the name of *charina*.

CHANNEL, in geography, an arm of the sea, or a narrow sea between two continents, or between a

continent

continent and an island. Such are the British channel, St George's channel, the channel of Constantinople, &c.

Channel *of a Ship*. *See* Chain-*Wales*.

CHAN-SI, a province of China, and one of the smallest in the empire, is bounded on the east by Petcheli, on the south by Honan, on the west by Chen-si, and on the north by the great wall. The climate is healthful and agreeable, and the soil generally fertile, though the country is full of mountains. Some of the last are rough, wild, and uninhabited; but others are cultivated with the greatest care from top to bottom, and cut into terraces, forming a very agreeable prospect; while some have on their tops vast plains no less fertile than the richest low-lands. These mountains abound with coal, which the inhabitants pound and make into cakes with water; a kind of fuel which, though not very inflammable, affords a strong and lasting fuel when once kindled. It is principally used for heating their stoves, which are constructed with brick as in Germany; but the inhabitants of this province give them the form of small beds, and sleep upon them. The best grapes to be met with in this part of Asia grow in the province of Chan-si; so that good wine might be made, but the people choose rather to dry and sell them to the neighbouring provinces. The country abounds with musk, prophyry, marble, lapis lazuli, and jasper of various colours; and iron mines as well as salt-pits and crystal are very common. Here are five cities of the first class, and eighty-five of the second and third: the most remarkable are, 1. Tai-youen-fou the capital, an ancient city about three leagues in circumference, but much decayed in consequence of being no longer the residence of the princes of the blood as it was formerly. Nothing now remains of the palaces of those princes but a few ruins: but their tombs are still to be seen on a neighbouring mountain. The burying-place is magnificently ornamented; and all the tombs are of marble or cut stone, having near them triumphal arches, statues of heroes, figures of lions and different animals, especially horses, and which are disposed in very elegant order. An awful and melancholy gloom is preserved around these tombs by groves of aged cypresses, which have never felt the stroke of an axe, placed chequer-wise. The principal articles of trade here are, hard-ware, stuffs of different kinds, particularly carpets in imitation of those of Turkey. 2. Ngan-y is situated near a lake as salt as the ocean, from which a great quantity of salt is extracted. 3. Fuen-tcheou-fou, an ancient and commercial city, built on the banks of the river Fuenho: it has baths and springs almost boiling hot, which by drawing hither a great number of strangers, add greatly to its opulence. 4. Tai-tong-fou; situated near the wall, is a place of great strength, and important by reason of its situation, as being the only one exposed to the incursions of the Tartars. Its territories abound with lapis lazuli, medicinal herbs, and a particular kind of jasper called *yieche*, which is as white and beautiful as agate; marble and prophyry are also common; and a great revenue is produced from the skins which are dressed here.

CHANT, *(cantus)*, is used for the vocal music of churches.

In church history we meet with divers kinds of *chant* or *song*. The first is the *Ambrosian*, established by St Ambrose. The second, the *Gregorian chant*, introduced by Pope Gregory the great, who established schools of chantors, and corrected the church-song. This is still retained in the church under the name of *plain song*: at first it was called the *Roman song*. The *plain* or *Gregorian chant*, is where the choir and people sing in unison, or all together in the same manner.



CHANTILLY, a village in France, about seven leagues from Paris, where there is a magnificent palace and fine forest belonging to the duke of Bourbon.

CHANTOR, a singer of a choir in a cathedral. The words is almost grown obsolete, *chorister* or *singing-man* being commonly used instead of it. All great chaptors have chantors and chaplains to assist the canons, and officiate in their absence.

Chantor is used by way excellence for the precentor master of the choir, which is one of the first dignities of the chapter. At St David's in Wales, where there is no dean, he is next in dignity to the bishop. The ancients called the chantor *primicerius cantorum*. To him belonged the direction of the deacons and other inferior officers.

Chantors, in the temple of Jerusalem, were a number of Levites employed in singing the praises of God, and playing upon instruments before his altar. They had no habits distinct from the rest of the people; yet in the ceremony of removing the ark to Solomon's temple, the chantors appeared dressed in tunics of byssus or fine linen. 2 Chron. v. 12.

CHANTRY, or Chauntry, was anciently a church or chapel endowed with lands, or other yearly revenue, for the maintenance of one or more priests, daily saying or singing mass for the souls of the donors, and such others as they appointed. Hence *chauntry-rents* are rents paid to the crown by the tenants or purchasers of *chauntry lands*.

CHAOLOGY the history or description of the choas. See Chaos.

Orpheus, in his chaology, sets forth the different alterations, secretions, and divers forms which matter went through till it became inhabitable, which amounts to the same with what we otherwise call *cosmogony*. Dr Burnet, in his theory of the earth represents the chaos as it was at first, entire, undivided, and universally rude and deformed; or the *tohu bohu*: then shews how it came to be divided into its respective regions; how the homogeneous matter gathered itself apart from all of a contrary principle; and lastly, how it hardened and became a solid habitable globe. See Earth.

CHAOS, that confusion in which matter lay when newly produced out of nothing at the beginning of the world, before God, by his almighty word, had put it into the order and condition wherein it was after the six days creation. See Earth.

Chaos is represented by the ancients as the first principle, ovum, or seed of nature and the world. All the sophists, sages, naturalists, philosophers, theologues, and poets, held that chaos was the eldest and first principle, το αρχαιον χαος. The Barbarians, Phœnicians, Egyptians, Persians, &c. all refer the origin of the world to a rude, mixed, confused mass of matter. The Greeks, Orpheus, Hesiod, Menander, Aristophanes, Euripides, and the writers of the Cyclic Poems, all

speak

ſpeak of the firſt chaos: the Ionic and Platonic Philoſophers build the world out of it. The Stoics hold, that as the world was firſt made of a chaos, it ſhall at laſt be reduced to a chaos; and that its periods and revolutions in the mean time are only tranſitions from one chaos to another. Laſtly, the Latins as Ennius, Varro, Ovid, Lucretius, Statius, &c. are all of the ſame opinion. Nor is there any ſect or nation whatever, that does not derive their διακοσμησις, *the ſtructure of the world*, from chaos.

The opinion firſt aroſe among the Barbarians, whence it ſpread to the Greeks, and from the Greeks to the Romans and other nations. Dr Burnet obſerves, that beſides Ariſtotle and a few other pſeudo-Pythagoreans, nobody ever aſſerted that our world was always from eternity of the ſame nature, form and ſtructure, as at preſent; but that it had been the ſtanding opinion of the wiſe men of all ages, that what we now call the *terreſtrial globe*, was originally an unformed, indigeſted maſs of heterogeneous matter, called *chaos*; and no more than the rudiments and materials of the preſent world.

It does not appear who firſt broached the notion of a chaos. Moſes, the eldeſt of all writers, drives the origin of this world from a confuſion of matter, dark, void, deep, without form, which he calls *tohu bohu*; which is preciſely the chaos of the Greek and Barbarian philoſophers. Moſes goes no further than the chaos; nor tells us whence it took its origin, or whence its confuſed ſtate; and where Moſes ſtops, there, preciſely, do all the reſt. Dr Burnet endeavours to ſhow, that as the ancient philoſophers, &c. who wrote of the coſmogony, acknowledged a chaos for the principle of their world; ſo the divines, or writers of the theogony, derive the origin or generation of their fabled gods from the ſame principle.

Mr Whiſton ſuppoſes the ancient chaos, the origin of our earth, to have been the atmoſphere of a comet; which, though new, yet, all things conſidered, is not the moſt improbable aſſertion. He endeavours to make it out by many arguments, drawn from the agreement which appears to be between them. So that, according to him, every planet is a comet, formed into a regular and laſting conſtitution, and placed at a proper diſtance from the ſun, revolving in a nearly circular orbit: and a comet is a planet either beginning to be deſtroyed or re-made; that is, a chaos or planet unformed or in its primæval ſtate, and placed as yet in an orbit very eccentrical.

Chaos, in the phraſe of Paracelſus, imports the air. It has alſo ſome other ſignifications amongſt the alchemiſts.

Chaos, in zoology, a genus of inſects belonging to the order of vermes zoophyta. The body has no ſhell or covering, and is capable of reviving after being dead to appearance for a long time: it has no joints or external organs of ſenſation. There are five ſpecies, moſtly obtained by infuſion of different vegetables in water, and only diſcoverable by the microſcope. See Animalcule.

CHAPEAU, in heraldry, an ancient cap of dignity worn by dukes, being ſcarlet-coloured velvet on the outſide, and lined with a fur. It is frequently borne above an helmet inſtead of a wreath, under gentlemens creſts.

CHAPEL, a place of divine worſhip, ſo called. The word is derived from the Latin *capella*. In former times when the kings of France were engaged in war they always carried St Martin's hat into the field, which was kept in a tent as a precious relic; from whence the place was called *capella*; and the prieſt, who had the cuſtody of the tent, *capellani*. Afterwards the word *capella* became applied to private oratories.

In Britain there are ſeveral ſorts of chapels. 1. Parochial chapels: theſe differ from pariſh-churches only in name; they are generally ſmall, and the inhabitants within the diſtrict few. If there be a preſentation *ad eccleſiam*, inſtead of *capellam*, and an admiſſion and inſtitution upon it, it is no longer a chapel, but a church. 2. Chapels, which adjoin to, and are part of the church; ſuch were formerly built by honourable perſons, as burying-places for themſelves and their families. 3. Chapels of eaſe; theſe are uſually built in very large pariſhes, where all the people cannot conveniently repair to the mother-church. 4. Free chapels; ſuch as were founded by kings of England. They are free from all epiſcopal juriſdiction, and only to be viſited by the founder and his ſucceſſors; which is done by the lord chancellor; yet the king may licenſe any ſubject to build and endow a chapel, and by letters patent exempt it from the viſitation of the ordinary. 5. Chapels in the univerſities, belonging to particular colleges. 6. Domeſtic chapels, built by noblemen or gentlemen for the private ſervice of God in their families. See Chaplain.

Chapel is alſo a name given to a printer's workhouſe; becauſe, according to ſome authors, printing was firſt actually performed in chapels or churches, or, according to others, becauſe Caxton, an early printer, exerciſed the art in one of the chapels in Weſtminſter Abby. In this ſenſe they ſay, *the orders* or *laws of the chapel, the ſecrets of the chapel*, &c.

*Knights of the Chapel*, called alſo *Poor knights of Windſor*, were inſtitued by Henry VIII. in his teſtament. Their number was at firſt thirteen, but has been ſince augmented to twenty-ſix. They aſſiſt in the funeral ſervices of the kings of England: they are ſubject to the office of the canons of Windſor, and live on penſions aſſigned them by the order of the garter. They bear a blue or red cloak, with the arms of St George on the left ſhoulder.

CHAPELAIN, (James) an eminent French poet born at Paris in 1595, and often mentioned in the works of Balzac, Menage, and other learned men. He wrote ſeveral works, and at length diſtinguiſhed himſelf by a heroic poem called *La Pucelle, ou France Delivrée*, which employed him ſeveral years; and which, raiſing the expectation of the public, was as much decried by ſome as extolled by others. He was one of the king's counſellors; and died in 1674, very rich, but was very covetous and ſordid.

CHAPELET, in the manege, a couple of ſtirrup-leathers, mounted each of them with a ſtirrup, and joined at top in a ſort of leather buckle, called the *head of the chapelet*, by which they are made faſt to the pummel of the ſaddle, after being adjuſted to the rider's length and bore. They are uſed both to avoid the trouble of taking up or letting down the ſturrups every time that the gentleman mounts on a different horſe and

and saddle, and to supply the place of the academy saddles, which have no stirrups to them.

CHAPELLE, (Claudius Emanuel Luillier) the natural son of Francis Lullier, took the name of *Chapelle* from a village between Paris and St Denys, where he was born. He distinguished himself by writing small pieces of poetry, in which he discovered great delicacy, an easy turn, and an admirable facility of expression. He was the friend of Gassendi and Moliere; and died in 1686.

CHAPERON, CHAPERONNE, or CHAPEROON, properly signifies a sort of hood or covering of the head anciently worn both by men and women, the nobles and the populace, and afterwards appropriated to the doctors, and licentiates in colleges, &c. Hence the name passed to certain little shields, and other funeral devices, placed on the foreheads of the horses that drew the hearses in pompous funerals, and which are still called *chaperoons*, or *shafferoons*; because such devices were originally fastened on the *chaperonnes*, or hoods, worn by those horses with their other coverings of state.

*CHAPERON of a bit-mouth*, in the manege, is only used for scatch-mouths, and all others that are not cannon-mouths, signifying the end of the bit that joins to the branch just by the banquet. In scatch-mouths the chaperon is round, but in others it is oval: and the same part that in scatch and other mouths is called *chaperon*, is in cannon-mouths called *fronceau*.

CHAPITERS, in architecture, the same with CAPITALS.

CHAPITERS, in law, formerly signified a summary of such matters as were inquired of, or presented before justices in eyre, justices of assize, or of the peace in their sessions.

Chapiters, at this time, denote such articles as are delivered by the mouth of the justice in his charge to the inquest.

CHAPLAIN properly signifies a person provided with a chapel; or who discharges the duty thereof.

CHAPLAIN is also used for an ecclesiastical person, in the house of a prince, or a person of quality, who officiates in their chapels, &c.

In England there are 48 chaplains to the king, who wait four each month, preach in the chapel, read the service to the family, and to the king in his private oratory, and say grace in the absence of the clerk of the closet. While in waiting they have a table, and attendance, but no salary. In Scotland the king has six chaplains, with a salary of L. 50 each, three of them having in addition the deanery of the chapel-royal divided between them, making up above L. 100 to each. Their only duty at present is to say prayers at the election of peers for Scotland to sit in parliament.——According to a statute of Henry VIII. the persons vested with a power of retaining chaplains, together with the number each is allowed to qualify, is as follows: An archbishop, eight; a duke or bishop, six; marquis or earl, five; viscount, four; baron, knight of the garter, or lord chancellor three; a duchess, marchioness, countess, baroness, the treasurer and comptroller of the king's house, clerk of the closet, the king's secretary, dean of the chapel, almoner, and master of the rolls, each of them two; chief justice of the kings bench, and warden of the cinque-parts, each one. All these chaplains may purchase a licence or dispensation, and take two benefices with cure of souls. A chaplain must be retained by letters testimonial under hand and seal; for it is not sufficient that he serve as chaplain in the family.



The first chaplains are said to have been those instituted by the ancient kings of France, for preserving the chape, or cape, with the other relics of St Martin, which the kings kept in their palace, and carried out with them to the war. The first chaplain is said to have been Gul. de Mesmes, chaplain to St Louis.

*CHAPLAIN in the order of Malta*, is used for the second rank, or class, in that order; otherwise called *diaco*.

The knights make the first class, and the chaplains the second.

*CHAPLAINS of the Pope*, are the auditors, or judges of causes in the sacred palace; so called, because the pope anciently gave audience in his chapel, for the decision of cases sent from the several parts of Christendom. He hither summoned as assessors the most learned lawyers of his time; and they hence acquired the appellation of *capellani*, chaplains. It is from the decrees formerly given by these, that the body of decretals is composed: their number pope Sixtus IV. reduced to twelve.

Some say, the shrines of relics were covered with a kind of tent, cape, or *capella*, i. e. little cape; and that hence the priests that had the care of them, were called chaplains. In time these relics where reposited in a little church, either contiguous to a larger, or separate from it; and the same name, *capella*, which was given to the cover, was also given to the place where it was lodged: and hence the priest who superintended it came to be called chaplain.

CHAPLET, an ancient ornament for the head, like a garland or wreath; but this word is frequently used to signify the circle of a crown. There are instances of its being borne in a coat of arms, as well as for crests; the paternal arms for Lascelles are argent, three chaplets, gules.

CHAPLET also denotes a string of beads used by the Roman Catholics, to count the number of their prayers. The invention of it is ascribed to Peter the hermit, who probably learned it of the Turks, as they owe it to the East-Indians.

Chaplets are sometimes called *pater-nosters*; and are made of coral, of diamonds, of wood, *&c.* The common chaplet contains fifty ave-marias, and five paternosters. There is also a chaplet of our Saviour, consisting of 33 beads, in honour of his 33 years living on earth, instituted by father Michael the Camaldusian.

The Orientals have a kind of chaplets which they call *chains*, and which they use in their prayers, rehearsing one of the perfections of God on each link or head. The great Mogul is said to have 18 of these chains, all precious stones; some diamonds, others rubies, pearls, &c. The Turks have likewise chaplets, which they bear in the hand, or hang it at the girdle; but father Dandini observes, they differ from those used by the Romanists, in that they are all of the same bigness, and have not that distinction into decads; though they consist of six decads, or 60 heads. He adds, that the mussulmans run over the chaplet almost in an instant, the prayers being extremely short, as containing only these words, "praise to God," or

Chaplet ‖ Chapter.

"glory to God," for each bead. Besides the common chaplet they have likewise a larger one consisting of 100 beads, where there is some distinction, as being divided by little threads into three parts; on one of which they repeat 30 times *soubhan Allah*, i. e "God is worthy to be praised;" on another, *ellamb Allah*, "glory be to God;" and on the third, *Allah echer*, "God is great." These thrice thirty times making only 90; to complete the number 100, they add other prayers for the beginning of the chaplet.—He adds, that the Mahometan chaplet appears to have had its rise from the *mea beracoth*, or "hundred benedictions; which the Jews are obliged to repeat daily, and which we find in their prayer-books; the Jews and Mahometans having this in common, that they scarce do any thing without pronouncing some laud or benediction.

Menage derives the word *chaplet* from *chapeau*, "hat." The modern Latins call it *chapellina*, the Italians more frequently *corona*.

CHAPLET, or *Chapelet*, in architecture, a little moulding, cut, or carved into round beads, pearls, olives, or the like.

CHAPMAN, (George) born in 1557, a man highly esteemed in his time for his dramatic and poetic works. He wrote 17 plays; translated Homer and some other ancient poets; and was thought no mean genius. He died in 1634; and he was buried in St Gile's in the fields, where his friend Inigo Jones erected a monument to him.

CHAPPE', in heraldry, the dividing an escutheon by lines drawn from the centre of the upper edge to the angles below, into three parts, the sections on the sides being of different metal or colour from the rest.

CHAPPEL IN FRITH, a market-town of Derbyshire, about 26 miles north-west of Derby; W. Long. 1. 50. N. Lat. 53. 22.

CHAPPEL, (William) a learned and pious bishop of Cork, Cloyne, and Ross, in Ireland, born in Nottinghamshire in 1582. When the troubles began under Charles I. he was prosecuted by the puritan party in parliament, and retired to Derby, where he devoted himself to study until his death in 1649. He wrote *Methodus Concionandi*, i. e. "the method of preaching:" and he is one of those to whom the *Whole Duty of Man* has been attributed. He left behind him also his own life written by himself in Latin, which has been twice printed.

CHAPTER, in ecclesiastical polity, a society or community of clergymen belonging to the cathedrals and collegiate churches.

It was in the eighth century that the body of canons began to be called a chapter. The chapter of the canons of a cathedral were a standing council to the bishop, and, during the vacancy of the see, had the jurisdiction of the diocese. In the earlier ages, the bishop was head of the chapter; afterwards abbots and other dignitaries, as deans, provosts, treasurers, &c. were preferred to this distinction. The deans and chapters had the privilege of choosing the bishops in England; but Henry VIII. got this power vested in the crown: and as the same prince expelled the monks from the cathedrals, and placed secular canons in their room, those he thus regulated were called deans and chapters of the new foundation; such are Canterbury, Winchester, Ely, Carlisle, &c. See DEAN.

Chapter ‖ Character.

CHAPTER, in matters in literature, a division in a book for keeping the subject treated of more clear and distinct.

CHAR, in ichthyology, a species of SALMO.

CHARA, in botany: A genus of the monandria order, belonging to the monœcia class of plants. There is neither male calyx nor corolla; and the anthera is placed under the germen. The female calyx is tetraphyllous; no corolla; the stigma quinquefid, with one roundish seed.

CHARABON, a sea-port town on the northern coast of the island of Java in the East-Indies; E. Long. 10. 8. S. Lat. 6.

CHARACENE, the most southern part of Susiana, a province of Persia, lying on the Persian gulph, between the Tigris and the Eulæus. It was so named from the city of Chorax, called first Alexandria, from its founder Alexander the Great; afterwards Antiochia, from Antiochus V. king of Syria, who repaired and beautified it; and lastly, Chorax Spasinæ, or Pasinæ, that is the Mole of the Spasines, an Arabian king of that name having secured it against the overflowing of the Tigris, by a high bank or mole extending three miles, which served as a fence to all that country. Dionysius Periegetes, and Isidorus, author of the Parthicæ Mansiones, were both natives of this city. The small district of Characene was seized by Pasines, the son of Sogodonacus, king of the neighbouring Arabs, during the troubles of Syria, and erected into a kingdom. Lucian calls him Hyspasines, and adds, that he ruled over the Characeni and the neighbouring people: he died in the 85th year of his age. The other kings of this country we find mentioned by the ancients are, Teræus, who died in the 92d year of his age, and after him Artabazus the seventh, as Lucian informs us, who was driven from the throne by his own subjects, but restored by the Parthians. And this is all we find in the ancients relating to the kings of Characene.

CHARACTER, in a general sense, signifies a mark or figure, drawn on paper, metal, stone, or other matter, with a pen, graver, chissel, or other instrument, to signify or denote any thing. The word is Greek, χαρακτηρ, formed from the verb, χαρασσειν, *insculpere*, "to ingrave, impress," &c.

The various kinds of characters may be reduced to three heads, viz. *Literal Characters*, *Numeral Characters*, and *Abbreviations*.

I. *Literal* CHARACTER, is a letter of the alphabet, serving to indicate some articulate sound, expressive of some idea or conception of the mind. See ALPHABET.

1. These may be divided, with regard to their nature and use, into *Nominal Characters*, or those we properly call *letters*; which serve to express the names of things: See LETTER. *Real Characters*; those that instead of names express things and ideas: See IDEA, &c. *Emblematical* or *Symbolical Characters*: which have this in common with real ones, that they express the things themselves; but have this further, that they in some measure personate them, and exibit their form: such are the hieroglyphics of the ancient Egyptians. See HIEROGLYPHIC, SYMBOL, &c.

2. *Literal* CHARACTERS may be again divided, with regard

regard to their invention and uſe, into *particular* and *general* or *univerſal.*

*Particular* CHARACTERS, are thoſe peculiar to this or that nation. Such are the Roman, Italic, Greek, Hebrew, Arabic, Gothic, Chineſe, &c. *characters.* See HEBREW, GOTHIC, CHINESE, *&c.*

*Univerſal* CHARACTERS, are alſo *real characters,* and make what ſome authors call a *Philoſophical Language.*

That diverſity of *characters* uſed by the ſeveral nations to expreſs the ſame idea, is found the chief obſtacle to the advancement of learning: to remove this, ſeveral authors have taken occaſion to propoſe plans of *characters* that ſhould be univerſal, and which each people ſhould read in their own language. The *character* here is to be real, not nominal: to expreſs things and notions; not as the common ones, letters or ſounds: yet to be mute like letters, and arbitrary; not emblematical like hieroglyphics.

Thus, every nation ſhould retain its own language, yet every one underſtand that of each other, without learning it; only by ſeeing a real or univerſal *character,* which ſhould ſignify the ſame things to all people, by what ſounds ſoever each expreſs it in their particular idiom. For inſtance, by ſeeing the *character* deſtined to ſignify *to drink,* an Engliſhman ſhould read *to drink;* a Frenchman, *boire;* a Latin, *bibere;* a Greek, πινειν; a Jew, שמה; a German *trincken;* and ſo of the reſt: in the ſame manner as ſeeing a horſe, each people expreſſes it after their own manner; but all mean the ſame animal.

This real *character* is no chimera; the Chineſe and Japoneſe have already ſomething like it. They have a common *character* which each of thoſe nations underſtand alike in their ſeveral languages; though they pronounce them with ſuch different ſounds, that they do not underſtand one another in ſpeaking.

The firſt and moſt conſiderable attempts for a *real character,* or philoſophical language, in Europe, are thoſe of biſhop Wilkins and Dalgarme: but theſe, with how much art ſoever they were contrived, have yet proved ineffectual.

M. Leibnitz had ſome thoughts the ſame way; he thinks thoſe great men did not hit the right method. It was probable, indeed, that by their means, people, who do not underſtand one another, might eaſily have a commerce together; but they have not hit on true *real characters.*

According to him, the *characters* ſhould reſemble thoſe uſed in Algebra: which, in effect, are very ſimple, yet very expreſſive, without any thing ſuperfluous or equivocal; and contain all the varieties required.

The *real character* of biſhop Wilkins has its juſt applauſe: Dr Hook recommends it on his own knowledge and experience as a moſt excellent ſcheme; and to engage the world to the ſtudy thereof, publiſhes ſome fine inventions of his own therein.

M. Leibnitz tells us, he had under conſideration an *alphabet of human thoughts;* in order to a new philoſophical language, on his own ſcheme: but his death prevented its being brought to maturity.

M. Lodwic, in the Engliſh *philoſophical tranſactions,* gives us a plan of *an univerſal alphabet* or *character* of another kind: this was to contain an enumeration of all ſuch ſingle ſounds, or letters, as are uſed in any language; by means whereof, people ſhould be enabled to pronounce truly and readily any language; to deſcribe the pronunciation of any language that ſhall be pronounced in their hearing, ſo as others accuſtomed to this language, though they had never heard the language pronounced, ſhall at firſt be able truly to pronounce it: and, laſtly, this *character* to ſerve as a ſtandard to perpetuate the ſounds of any language. In the Journal Literaire, *an.* 1720, we have a very ingenious project for an univerſal *character.* The author, after obviating the objections that might be made againſt the feaſibleneſs of ſuch ſchemes in the general, propoſes his own: his *characters* are to be the common Arabic, or numeral figures. The combinations of theſe nine are ſufficient to expreſs diſtinctly an incredible quantity of numbers, much more than we ſhall need terms to ſignify our actions, goods, evils, duties, paſſions, &c. Thus is all the trouble of framing and learning any new *character* at once ſaved; the Arabic figures having already all the univerſality required.

The advantages are immenſe. For, 1*mo,* We have here a ſtable, faithful interpreter; never to be corrupted or changed, as the popular languages continually are. 2*do,* Whereas the difficulty of pronouncing a foreign language is ſuch as uſually gives the learner the greateſt trouble, and there are even ſome ſounds which foreigners never attain to; in the *character* here propoſed, this difficulty has no place: every nation is to pronounce them according to the particular pronunciation that already obtains among them. All the difficulty is, the accuſtoming the pen and the eye to affix certain notions to *characters* that do not, at firſt ſight, exhibit them. But this trouble is no more than we find in the ſtudy of any language whatever.

The inflections of words are here to be expreſſed by the common letters. For inſtance the ſame *character* ſhall expreſs a *filly* or a *colt,* a *horſe* or a *mare,* an *old horſe* or an *old mare,* as accompanied with this or that diſtinctive letter, which ſhall ſhow the ſex, youth, maturity, or old age: a letter alſo to expreſs the bigneſs or ſize of things; thus *v. g.* a man with this or that letter, to ſignify a *great man,* or a *little man,* &c.

The uſe of theſe letters belongs to the grammar; which, once well underſtood, would abridge the vocabulary exceedingly. An advantage of this grammar is, that it would only have one declenſion and one conjugation: thoſe numerous anomalies of grammarians are exceeding troubleſome; and ariſe hence, that the common languages are governed by the populace, who never reaſon on what is beſt: but in the character here propoſed, men of ſenſe having the introduction of it, would have a new ground whereon to build regularly.

But the difficulty is not in inventing the moſt ſimple, eaſy, and commodious *character,* but in engaging the ſeveral nations to uſe it; there being nothing they agree leſs in, than the underſtanding and purſuing their common intereſt.

3. Literal characters may again be divided, with reſpect to the nations among whom they have been invented, into Greek characters, Roman characters, Hebrew characters, &c. The Latin character now uſed through all Europe, was formed from the Greek, as the Greek was from the Phœnician; and the Phœnician, as

Characters. as well as the Chaldee, Syriac, and Arabic characters, were formed from the ancient Hebrew, which subsisted till the Babylonish captivity; for after that event the character of the Assyrians, which is the square Hebrew now in use, prevailed, the ancient being only found on some Hebrew medals, commonly called Samaritan medals. It was in 1091, that the Gothic characters, invented by Ulfilas, were abolished, and the Latin ones established in their room.

Medallists observe, that the Greek character, consisting only of majuscule letters, has preserved its uniformity on all medals, as low as the time of Gallienus, from which time it appears somewhat weaker and rounder: from the time of Constantine to Michael we find only Latin characters: after Michael, the Greek characters recommence; but from that time they began to alter with the language, which was a mixture of Greek and Latin. The Latin medals preserve both their character and language as low as the translation of the seat of the empire to Constantinople: towards the time of Decius the character began to lose its roundness and beauty; some time after, it retrieved, and subsisted tolerably till the time of Justin, when it degenerated gradually into the Gothic. The rounder, then, and better formed a character is upon a medal, the fairer pretence it has to antiquity.

II. *Numeral Characters*, are characters used to express numbers, are either letters or figures.

The Arabic character, called also the common one, because it is used almost throughout Europe in all sorts of calculations, consists of these ten digits, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

The Roman numeral character consists of seven majuscule letters of the Roman alphabet, *viz.* I, V, X, L, C, D, M. The I denotes one, V five, X ten, L fifty, C, a hundred, D, five hundred, and M a thousand. The I repeated twice makes two, II; thrice, three, III: four is expressed thus IV, as I before V or X takes an unit from the number expressed by these letters. To express six, an I is added to a V, VI; for seven, two, VII; and for eight, three, VIII. nine is expressed by an I before X, thus IX. The same remark may be made of the X before L or C, except that the diminution is by tens; thus XL denotes forty, XC ninety, and LX sixty. The C before D or M diminishes each by a hundred. The number five hundred is sometimes expressed by an I before a C inverted thus, IƆ; and instead of M, which signifies a thousand, an I is sometimes used between two C's, the one direct, and the other inverted, thus CIƆ. The addition of C and Ɔ before or after raises CIƆ by tens, thus, CCIƆƆ expresses ten thousand, CCCIƆƆƆ, a hundred thousand. The Romans also expressed any number of thousands by a line drawn over any numeral less than a thousand; thus $\overline{\text{V}}$ denotes five thousand, $\overline{\text{LX}}$, sixty thousand: so likewise $\overline{\text{M}}$ is one million, $\overline{\text{MM}}$ is two millions, &c.

The Greeks had three ways of expressing numbers: 1. Every letter, according to its place in the alphabet, denoted a number, from α, one, to ω, twenty-four. 2. The alphabet was divided into eight units, α one, β two, three, *&c.*; into γ eight tens, ι ten, κ twenty, λ thirty, *&c.*; and eight hundreds, ρ one hundred, σ two hundred, τ three hundred, *&c.* 3. I stood for one, Π five, Δ ten, Η a hundred, Χ a thousand, Μ ten thousand; and when the letter $\overline{\text{Π}}$ inclosed any of these, except I, it showed the inclosed letter to be five times its value: as $\overline{|\Delta|}$ fifty, $\overline{|\text{H}|}$ five hundred, $\overline{|\text{X}|}$ five thousand, $\overline{|\text{M}|}$ fifty thousand.

*The French Character* used in the chamber of accounts, and by persons concerned in the management of the revenue, is, properly speaking, nothing else than the Roman numerals, in letters that are not majuscule: thus, instead of expressing fifty-six by LVI, they denote it by smaller characters lvj.

III. Characters of Abbreviations, &c. in several of the arts, are symbols contrived for the more concise and immediate conveyance of the knowledge of things. For the

*Characters used in Algebra.* See Algebra, Introduction.

*Characters used in Astronomy*, viz.

Of the Planets. See Plate LXII. fig. 19.

Of the Signs. Plate LXXVI. fig. 158. & LXXXV. fig. 204.

Of the Aspects.

| | |
|---|---|
| ☌ or S Conjunction | △ Trine |
| SS Semisextile | Bq Biquintile |
| ✻ Sextile | Vc Quincunx |
| Q Quintile | ☍ Opposition. |
| □ Quartile | ☊ Dragon's head |
| Td Tredecile | ☋ Dragon's tail. |

Of time.

A. M. *ante meridiem*, before the sun comes upon the meridian.

O. or N. noon.

P. M. *post meridiem*, when the sun is past the meridian.

*Characters in Commerce.*

| | |
|---|---|
| D° *ditto*, the same | R° *recto* } *folio* |
| N° *numero*, or number | V° *vero* } *folio* |
| F° *folio*, or page | |
| C or ⊕ hundred weight, or 112 pounds | £ or *l.* pounds sterling |
| | p^r *per*, or by, as p^r *ann.* by the year, p^r *cent.* |
| q^rs quarters | R^x rixdollar |
| S or *s* shillings | D^t ducat |
| *d* pence or deniers | P. S. postscript, *&c.* |
| ℔ pound weight. | |

*Characters in Chemistry.* See Pl. cxxxii. & cxxxiii.

*Characters in Geometry and Trigonometry.*

| | |
|---|---|
| ‖ the character of parallelism | $\underline{\underline{\vee}}$ equiangular, or similar |
| △ triangle | ≟ equilateral |
| □ square | < an angle |
| ▯ ▭ rectangle | ∟ right angle |
| ⊙ circle | ⊥ perpendicular |

° denotes a degree; thus 45° implies 45 degrees.

′ denotes a minute; thus 50′, is 50 minutes. ″, ‴, ⁗, denotes seconds, thirds, and fourths: and the same characters are used where the progressions are by tens, as it is here by sixties.

*Characters in Grammar, Rhetoric, Poetry, &c.*

| | |
|---|---|
| () parenthesis | D. D. doctor in divinity. |
| [] crotchet | |
| - hyphen | V. D. M. minister of the word of God. |
| ' apostrophe | |
| ´ emphasis or accent | L. L. D. doctor of laws |
| ˘ breve | J. V. D. doctor of civil and canon law |
| ¨ dialysis | |
| ^ caret and circumflex | " quotation |
| † ‡ and * references | M. D. doctor in physic. |

§

Character.

§ section or division | A. M. master of arts
¶ paragraph | A. B. bachelor of arts

F. R. S. fellow of the royal society.

For the other characters used in grammar, see COMMA, COLON, SEMICOLON, *&c.*

*CHARACTERS among the ancient Lawyers, and in ancient Inscriptions.*

| | |
|---|---|
| § paragraphs | P. P. pater patriæ |
| ff digests | C. code |
| Scto. senatus consulto | C. C. consules |
| E. extra | T. titulus |
| S. P. Q. R. senatus populusque Romanus | P. P. D. D. propria pecunia dedicavit |
| | D. D. M. dono dedit monumentum. |

*CHARACTERS in Medicine and Pharmacy.*

| | |
|---|---|
| ℞ recipe | M. manipulus, a handful |
| ā, āā, or ana, of each alike | P. a pugil |
| ℔ a pound, or a pint | P. Æ. equal quantities |
| ℥ an ounce | S. A. according to art |
| ʒ a drachm | q. s. a sufficient quantity |
| ℈ a scruple | q. pl. as much as you please |
| gr. grains | P. P. pulvis patrum, the Jesuit's bark. |
| ss or *ſs* half of any thing | |
| cong. congius, a gallon, | |
| coch. cochleare, a spoonful | |

*CHARACTERS upon Tomb-stones.*

S. V. Siste viator, *i. e.* Stop traveller.

M. S. Memoriæ sacrum, *i. e.* Sacred to the memory.

D. M. Diis manibus.

J. H. S. Jesus.

X. P. a character found in the catacombs, about the meaning of which authors are not agreed.

*CHARACTERS used in Music, and of Musical Notes with their proportions, are as follow.*

| | | | | | |
|---|---|---|---|---|---|
| 𝆷 | character of a large | 8 | 𝅘𝅥 | crotchet | $\frac{1}{4}$ |
| 𝆸 | a long | 4 | 𝅘𝅥𝅮 | quaver | $\frac{1}{8}$ |
| 𝅜 | a breve | 2 | 𝅘𝅥𝅯 | semiquaver | $\frac{1}{16}$ |
| 𝅝 | a semibreve | 1 | 𝅘𝅥𝅰 | demisemiquaver | $\frac{1}{32}$ |
| 𝅗𝅥 | a minim | $\frac{1}{2}$ | | | |

※ character of a sharp note: this character at the beginning of a line or space, denotes that all the notes in that line are to be taken a semitone higher than in the natural series; and the same affects all the octaves above and below, though not marked: but when prefixed to any particular note it shows that note alone to be taken a semitone higher than it would be without such character.

♭ or *b*, character of a flat note: this is the contrary to the other above; that is, a semitone lower.

♮ character of a natural note: when in a line or series of artificial notes, marked at the beginning *b* or ※, the natural note happens to be required, it is denoted by this character

𝄞 character of a treble cliff.

𝄡 character of the mean cliff.

𝄢 bass cliff.

$\frac{2}{4}$, or $\frac{4}{8}$ characters of common duple time, signifying the measure of two crotchets to be equal to two notes, of which four make a semibreve.

C ₵ Ͻ, characters that distinguish the movements of common time, the first implying slow, the second quick, and the third very quick.

$\frac{3}{1}$, $\frac{3}{2}$, $\frac{3}{4}$, $\frac{3}{8}$, $\frac{3}{16}$, characters of simple triple time, the measure of which is equal to three semibreves, or to three minims.

$\frac{6}{4}$, $\frac{6}{8}$, or $\frac{6}{16}$, characters of a mixed triple time, where the measure is equal to six crotchets, or six quavers.

$\frac{9}{4}$, or $\frac{9}{8}$, or $\frac{9}{16}$, or $\frac{9}{1}$, or $\frac{9}{2}$, characters of compound triple time.

$\frac{12}{4}$, $\frac{12}{8}$, $\frac{12}{16}$, or $\frac{12}{1}$, or $\frac{12}{2}$, characters of that species of triple time called the measure of twelve times.

CHARACTER, in human life, that which is peculiar in the manners of any person, and distinguishes him from all others.

*Good CHARACTER* is particularly applied to that conduct which is regulated by virtue and religion; in an inferior but very common sense, it is understood of mere honesty of dealing between man and man The importance of a good character in the commerce of life seems to be universally acknowledged.—To those who are to make their own way either to wealth or honours, a good character is usually no less necessary than address and abilities. To transcribe the observation of an elegant moralist: Though human nature is degenerate, and corrupts itself still more by its own inventions; yet it usually retains to the last an esteem for excellence. But even if we are arrived at such an extreme degree of depravity as to have lost our native reverence for virtue; yet a regard to our own interest and safety, which we seldom lose, will lead us to apply for aid, in all important transactions, to men whose integrity is unimpeached. When we choose an assistant, a partner, a servant, or first enquiry is concerning his character. When we have occasion for a counsellor or attorney, a physician or apothecary, whatever we may be ourselves, we always choose to trust our property and persons to men of the best character. When we fix on the tradesmen who are to supply us with necessaries, we are not determined by the sign of the lamb, or the wolf, or the fox; nor by a shop fitted up in the most elegant taste, but by the fairest reputation. Look into a daily newspaper, and you will see, from the highest to the lowest rank, how important the characters of the employed appear to the employers. After the advertisement has enumerated the qualities required in the person wanted, there constantly follows, that none need apply who cannot bring an undeniable character. Offer yourself as a candidate for a seat in the legislature, be promoted to honour and emolument, or in any respect attract the attention of mankind upon yourself, and, if you are vulnerable in your character, you will be deeply wounded. This is a general testimony in favour of honesty, which no writings and no practices can possibly refute.

Young men, therefore, whose characters are yet unfixed, and who, consequently, may render them just such as they wish, ought to pay great attention to the first steps which they take on entrance into life. They are usually careless and inattentive to this object. They pursue their own plans with ardour, and neglect the opinions which others entertain of them. By some thoughtless action or expression, they suffer a mark to be impressed upon them, which scarcely any subsequent merit can entirely erase. Every man will find some persons, who, though they are not professed enemies, yet view him with an envious or a jealous eye, and who will gladly revive any tale to which truth has given the slightest foundation.

In this turbulent and confused scene, where our words and actions are often misunderstood, and oftener misrepresented, it is indeed difficult even for innocence and integrity to avoid reproach, abuse, contempt, and hatred. These not only hurt our interest and impede our advancement in life, but sorely afflict the feelings of a tender and delicate mind. It is then the part of wisdom first to do every thing in our power to preserve an irreproachable character, and then to let our happiness depend chiefly on the approbation of our own consciences, and on the advancement of our interest in a world where liars shall not be believed, and where slanderers shall receive countenance from none but him who, in Greek, is called, by way of eminence, *Diabolus*, or the calumniator.

Character, in poetry, particularly the epopee and drama, is the result of the manners or peculiarities by which each person is distinguished from others.

The poetical character, says Mr Bossu, is not properly any particular virtue or quality, but a composition of several which are mixed together, in a different degree, according to the necessity of the fable and the unity of the action: there must be one, however, to reign over all the rest; and this must be found, in some degree, in every part. The first quality in Achilles, is wrath; in Ulysses, dissimulation; and in Æneas, mildness: but as these characters cannot be alone, they must be accompanied with others to embellish them, as far as they are capable, either by hiding their defects, as in the anger of Achilles, which is palliated by extraordinay valour; or by making them centre in some solid virtue, as in Ulysses, whose dissimulation makes a part of his prudence; and in Æneas, whose mildness is employed in a submission to the will of the gods. In the making up of which union, it is to be observed, the poets have joined together such qualities as are by nature the most compatible; valour with anger, piety with mildness, and prudence with dissimulation. The fable required prudence in Ulysses, and piety in Æneas; in this, therefore, the poets were not left to their choice: but Homer might have made Achilles a coward without abating any thing from the justness of his fable: so that it was the necessity of adorning his character that obliged him to make him valiant: the character, then, of a hero in the epic poem, is compounded of three sorts of qualities; the first essential to the fable; the second, embellishments of the first; and valour, which sustains the other two, makes the third.

Unity of character is as necessary as the unity of the fable. For this purpose a person should be the same from the beginning to the end: not that he is always to betray the same sentiments, or one passion; but that he should never speak nor act inconsistently with his fundamental character. For instance, the weak may sometimes sally into a warmth, and the breast of the passionate be calm, a change which often introduces in the drama a very affecting variety; but if the natural disposition of the former was to be represented as boisterous, and that of the latter mild and soft, they would both act out of character, and contradict their persons.



True characters are such as we truly and really see in men, or may exist without any contradiction to nature: no man questions but there have been men as generous and as good as Æneas, as passionate and as violent as Achilles, as prudent and wise as Ulysses, as impious and atheistical as Mezentius, and as amorous and passionate as Dido; all these characters, therefore, are true, and nothing but just imitations of nature. On the contrary, a character is false when an author so feigns it, that one can see nothing like it in the order of nature wherein he designs it shall stand: these characters should be wholly excluded from a poem, because transgressing the bounds of probability and reason, they meet with no belief from the readers; they are fictions of the poet's brain, not imitations of nature; and yet all poetry consists in an imitation of nature.

Character is also used for certain visible qualities, which claim respect or reverence to those vested therewith.—The majesty of kings gives them a character which procures respect from the people. A bishop should sustain his character by learning and solid piety, rather than by worldly lustre, &c. The law of nations secures the character of an ambassador from all insults.

Character, among naturalists, is synonymous with the definition of the genera of animals, plants, &c.

CHARACTERISTIC, in the general, is that which characterises a thing or person, i. e. constitutes its character, whereby it is distinguished. See Character.

Characteristic, is peculiarly used in grammar, for the principal letter of a word: which is preserved in most of its tenses and moods, its derivatives and compounds.

*Characteristic of a Logarithm*, is its index or exponent. See Logarithm.

*Characteristic Triangle of a Curve*, in the higher geometry, is a rectilinear right-angled triangle, whose hypothenuse makes a part of the curve, not sensibly different from a right-line. It is so called, because curve lines are used to be distinguished hereby. See Curve.

CHARADE, the name of a new species of composition or literary amusement. It owes its name to the idler who invented it. Its subject must be a word of two syllables, each forming a distinct word; and these two syllables are to be concealed in an enigmatical description, first separately, and then together. The exercise of charades, if not greatly instructive, is at least innocent and amusing. At all events, as it has made its way into every fashionable circle, and has employed even Garrick, it will scarcely be deemed unworthy of attention. The sillinesses indeed of most that have appeared in the papers under this title, are not only destitute of all pleasantry in the stating, but are formed in general of words utterly unfit for the purpose. They have therefore been treated with the contempt they deserved. In trifles of this nature, inaccuracy is without excuse. The following examples therefore are at least free from this blemish.

I.

My *first*, however here abused,
Designs the sex alone;
In Cambria, such is custom's pow'r,
'Tis Jenkin, John, or Joan.

My

My *second* oft is loudly call'd,
When men prepare to fift it:
Its name delights the female ear;
Its force, may none refift it!
It binds the weak, it binds the ftrong,
The wealthy and the poor;
Still 'tis to joy a paffport deem'd,
For fullied fame a cure.
It may infure an age of blefs,
Yet mif'ries oft attend it;
To fingers, ears, and nofes too,
Its various lords commend it.
My *whole* may chance to make one drink,
Though vended in a fifh-fhop;
'Tis now the monarch of the feas,
And has been an archbifhop. *Her-ring.*

II.

My *firft*, when a Frenchman is learning Englifh, ferves him to fwear by. My *fecond*, is either hay or corn. My *whole* is the delight of the prefent age, and will be the admiration of pofterity. *Gar-rick.*

III.

My *firft*, is plowed for various reafons, and grain is freqently buried in it to little purpofe. My *fecond*, is neither riches nor honours; yet the former would generally be given for it, and the latter is often taftelefs without it. My *whole* applies equally to fpring, fummer, atumn, and winter; and both fifh and flefh, praife and cenfure, mirth and melancholly, are the better for being in it. *Sea-fon.*

IV.

My *firft*, with the moft rooted antipathy to a Frenchman, prides himfelf, whenever they meet, upon fticking clofe to his jacket. My *fecond* has many virtues, nor is it its leaft that it gives name to my firft. My *whole*, may I never catch! *Tar-tar.*

V

My *firft* is one of England's prime boafts; it rejoices the ear of a horfe, and anguifhes the toe of a man. My *fecond*, when brick is good; when ftone, better; when *wooden*, beft of all. My *whole* is famous alike for rottennefs and tin. *Corn-wall.*

VI.

My *firft* is is called bad or good,
May pleafure or offend ye;
My *fecond*, in a thirfty mood,
May very much befriend ye.
My *whole*, tho' ftyled a "cruel word,"
May yet appear a kind one;
It often may with joy be heard,
With tears may often blind one. *Fare-well.*

VII.

My *firft* is equally friendly to the thief and the lover, the toper, and the ftudent. My *fecond* is light's oppofite: yet they are frequently feen hand in hand; and their union, if judicious, gives much pleafure. My *whole*, is tempting to the touch, grateful to the fight, fatal to the tafte. *Night-fhade.*

CHARADRIUS, in ornithology, a genus belonging to the order of grallæ. The beak is cylindrical and blunt; the noftrils are linear; and the feet have three toes.

1. The Hiaticula, or Sea-lark of Ray, has a black breaft; a white ftreak along the front; the top of the head is brown; and the legs and beak are reddifh. It is found on the fhores of Europe and America. They frequent our fhores in the fummer, but are not numerous. They lay four eggs, of a dull whitifh colour, fparingly fprinkled with black: at the approach of winter they difappear.

2. The Alexandrinus, or Alexandrian Dotterel, is of a brownifh colour, with the forehead, collar, and belly white; the prime tail-feathers on both fides are white; and the legs are black. It is about the fize of a lark, and lives upon infects.

3. The Vociferous, or Noify Plover of Catefby, has black ftreaks on the breaft, neck, forehead, and cheeks; and the feet are yellow. It is a native of North-America.

4. The Egyptius, has a black ftreak on the breaft, white eye-brows, the prime tail-feathers ftreaked with black at the points, and bluifh legs. It is found in the plains of Egypt, and feeds on infects.

5. The Morinellus has an iron-coloured breaft, a fmall white ftreak on the breaft and eye-brows, and black legs. It is the Dotterel of Ray, and a native of Europe. They are found in Cambridgefhire, Lincolnfhire, and Derbyfhire: on Lincoln-heath, and on the moors of Derbyfhire, they are migratory; appearing there in fmall flocks of eight or ten only in the latter end of April, and ftay there all May and part of June, during which time they are very fat, and much efteemed for their delicate flavour. In the months of April and September, they are taken on the Wiltfhire and Berkfhire downs; they are alfo found in the beginning of the former month on the fea-fide at Meales in Lancafhire, and continue there about three weeks, attending the barley fallows: from thence they remove northward to a place called *Leyton Haws*, and ftay there about a fortnight; but where they breed, or where they refide during the winter, we have not been able to difcover. They are reckoned very foolifh birds, fo that a dull fellow is proverbially ftyled a *dotterel*. They were alfo believed to mimic the action of the fowler, ftretching out a wing when he ftretches out an arm, &c. continuing their imitation, regardlefs of the net that is fpreading for them.

6. The Apricarius has a black belly; the body is brown, and variegated with white and yellow fpots; and the legs are afh-coloured. It is the fpotted Plover of Edwards, and a native of Canada.

7. The Pluvialis is black above, with green fpots, white underneath, and the feet are afh-coloured. It is the green plover of Ray, and is a native of Europe. They lay four eggs, fharply pointed at the leffer end, of a dirty white colour, and irregularly marked, efpecially at the thicker end, with blotches and fpots. It breeds on feveral unfrequented mountains of Scotland; and is very common on thefe of the ifle of Rum, and others of the loftier Hebrides. They make a fhrill whiftling noife; and may be enticed within a fhot by a fkilful imitator of the note.

8. The Torquatus has a black breaft, and a white front; the top of the head and the collar is black; and the beak and feet are bluifh. It is a native of St Domingo.

9. The Calidris has black feet, and a black bill; the rump is greyifh; and the body is pure white below. It frequents the fhores of Europe.

10. The Oedicnemus or Stone-curlew of Ray, is of a grey colour, with two of the prime wing-feathers black, but white in the middle: it has a fharp bill, and

and ash-coloured feet; and is about the size of a crow. In Hampshire, Norfolk, and on Lincoln-heath, it is called the stone-curlew, from a similarity of colours to the curlew. It breeds in some places in rabbit-burrows; also among stones on the bare ground, laying two eggs of a copper-colour spotted with a darker red. The young run soon after they are hatched. These birds feed in the night on worms and caterpillars: they will also eat toads, and will catch mice. They inhabit fallow lands and downs; affect dry places, never being seen near any waters. When they fly, they extend their legs straight out behind: are very shy birds; run far before they take to wing; and often squat: are generally seen single; and are esteemed very delicate food.—Hasselquist informs us, that this bird is also met with in Lower Egypt, in the Acacia groves, near the villages Abusir and Sackhara, near the sepulchres of the ancient Egyptians, and in the desarts. The Arabians call it Kervan. It has a shrill voice, somewhat resembling that of the black woodpecker, which it raises and lowers successively, uttering agreeable notes. The Turks and Egyptians value it much, if they can get it alive; and keep it in a cage for the sake of its singing. Its flesh is hard, and of a very good taste, inclined to aromatic. It is a very voracious bird, catching and devouring rats and mice, which abound in Egypt. It seldom drinks; and when taken young, and kept in a cage in Egypt, they give it no water for several months, but feed it with fresh meat macerated in water, which it devours very greedily. It is found in desarts, and is therefore accustomed to be without water.

11. The Himantopus is white below, with a black back, and a long black bill; the feet are red, and very long. It is the autumnal dotterel of the English authors, and frequents the sea shores of Europe. It is also found in the lakes of Egypt in the month of October.

12. The Spinosus, armed Dotterel, or Lapwing, has black breast, legs, and wings; it has a crest on the hinder part of the head. It is of the size of a pigeon; the French call it *dominicanus*, from the resemblance it has to the dress of a Dominican monk. It is a native of Egypt.

13. The New-Zealand plover, has the forepart of the head, taking in the eye, chin, and throat, black, passing backward in a collar at the hind-head; all the back part of the head, behind the eye, greenish ash-colour; these two colours divided by white: the plumage on the upper parts of the body is the same colour as the back of the head: the quills and tail are dusky: the last order of coverts is white for some part of their length, forming a bar on the wing: the under parts of the body are white; and the legs red. It inhabits Queen Charlotte's sound; where it is known by the name of *Doodooroa-attoo*. See Plate CXXII. There are 12 or 13 more species.

CHARAG, the tribute which Christians and Jews pay to the grand signior.

It consists of ten, twelve, or fifteen franks *per annum*, according to the estate of the party. Men begin to pay it at nine or at sixteen years old; women are dispensed with, as also priests, rabbins, and religious.

CHARAIMS, a sect of the Jews in Egypt. They live by themselves, and have a separate synagogue; and as the other Jews are remarkable for their eyes, so are those for their large noses, which run through all the families of this sect. These are the ancient Essenes. They strictly observe the five books of Moses, according to the letter; and receive no written traditions. It is said that the other Jews would join the *Charaims*; but those not having observed the exact rules of the law with regard to divorces, these think they live in adultery.



CHARANTIA, in botany. See MOMORDICA.

CHARBON, in the manege, that little black spot or mark which remains after a large spot in the cavity of the corner teeth of a horse: about the seventh or eighth year, when the cavity fills up, the tooth being smooth and equal, it is said to be rased.

CHARCAS, the southern division of Peru in South America, remarkable for the silver mines of Potosi.

CHARCOAL, a sort of artificial coal, or fuel, consisting of wood half burnt; chiefly used where a clear strong fire, without smoke, is required; the humidity of the wood being here mostly dissipated, and exhaled in the fire wherein it is prepared.

The microscope discovers a surprising number of pores in charcoal; they are disposed in order, and traverse it lengthwise; so that there is no piece of charcoal, how long soever, but may be easily blown through. If a piece be broken pretty short, it may be seen through with a microscope. In a range the 18th part of an inch long, Dr Hook reckoned 150 pores; whence he concludes, that in a charcoal of an inch diameter, there are no less than 5,724,000 pores. It is to this prodigious number of pores, that the blackness of charcoal is owing; for the rays of light striking on the charcoal, are received and absorbed in its pores, instead of being reflected; whence the body must of necessity appear black, blackness in a body being no more than a want of reflection. Charcoal was anciently used to distinguish the bounds of estates and inheritances; as being incorruptible, when let very deep within ground. In effect, it preserves itself so long, that there are many pieces found entire in the ancient tombs of the northern nations. M. Dodart says, there is charcoal made of corn, probably as old as the days of Cæsar: he adds, that it has kept so well, that the wheat may be still distinguished from the rye; which he looks on as proof of its incorruptibility.

The operation of charring wood, is performed in the following manner: The wood intended for this purpose is cut into proper lengths, and piled up in heaps near the place where the charcoal is intended to be made: when a sufficient quantity of wood is thus prepared, they begin constructing their stacks, for which there are three methods. The first is this: They level a proper spot of ground, of about twelve or fifteen feet in diameter, near the piles of wood; in the centre of this area a large billet of wood, split across at one end and pointed at the other, is fixed with its pointed extremity in the earth, and two pieces of wood inserted through the clefts of the other end, forming four right angles; against these cross pieces four other billets of wood are placed, one end on the ground, and the other leaning against the angles. This being finished, a number of large and straight billets

Charcoal. billets are laid on the ground to form a floor, each being as it were the radius of the circular area; on this floor a proper quantity of brush or small wood is strewed, in order to fill up the interstices, when the floor will be complete; and in order to keep the billets in the same order and position in which they were first arranged, pegs or stumps are driven into the ground in the circumference of the circle, about a foot distant from one another: upon this floor a stage is built with billets set upon one end, but something inclining towards the central billet; and on the tops of these another floor is laid in a horizontal direction, but of shorter billets, as the whole is, when finished, to form a cone.

The second method of building the stacks for making charcoal is performed in this manner: A long pole is erected in the centre of the area above described, and several small billets ranged round the pole on their ends: the interstices between these billets and the pole is filled with dry brush-wood, then a floor is laid, on that a stage in a reclining position, and on that a second floor, *&c.* in the same manner as described above; but in the lower floor there is a billet larger and longer than the rest, extending from the central pole to some distance beyond the circumference of the circle.

The third method is this: A chimney, or aperture of a square form, is built with billets in the centre, from the bottom to the top; and round these, floors and inclined stages are erected, in the same manner as in the stacks above described, except that the base of this instead of being circular like the others, is square; and the whole stack, when completed, forms a pyramid.

The stack of either form being thus finished, is coated over with turf, and the surface plastered with a mixture of earth and charcoal-dust well tempered together.

The next operation is the setting the stack on fire. In order to this, if it be formed according to the first construction, the central billet in the upper stage is drawn out, and some pieces of very dry and combustible wood are placed in the void space, called, by workmen, the chimney, and fire set to these pieces. If the stack be built according to the second construction, the central pole is drawn out, together with the large horizontal billet above described; and the void space occupied by the latter being filled with pieces of very dry combustible wood, the fire is applied to it at the base of the stack. With regard to the third construction, the square aperture or chimney is filled with small pieces of very dry wood, and the fire applied to it at the top or apex of the pyramidal stack. When the stack is set on fire, either at the top or bottom, the greatest attention is necessary in the workman; for in the proper management of the fire the chief difficulty attending the art of making good charcoal consists. In order to this, care is taken, as soon as the flame begins to issue some height above the chimney, that the aperture be covered with a piece of turf, but not so close as to hinder the smoke from passing out: and whenever the smoke appears to issue very thick from any part of the pile, the aperture must be covered with a mixture of earth and charcoal dust. At the same time, as it is necessary that every part of the stack should be equally burnt, it will be requisite for the workman to open vents in one part and shut them in another. In this manner the fire must be kept up till the charcoal be sufficiently burnt, which will happen in about two days and a half, if the wood be dry; but if green the operation will not be finished in less than three days. When the charcoal is thought to be sufficiently burnt, which is easily known from the appearance of the smoke, and the flames no longer issuing with impetuosity through the vents; all the apertures are to be closed up very carefully with a mixture of earth and charcoal-dust, which by excluding all access of the external air, prevents the coals from being any further consumed, and the fire goes out of itself. In this condition it is suffered to remain, till the whole is sufficiently cooled; when the cover is removed and the charcoal is taken away. If the whole process is skilfully managed, the coals will exactly retain the figure of the pieces of wood: some are said to have been so dexterous as to char an arrow without altering even the figure of the feather.

There are considerable differences in the coals of different vegetables, in regard to their habitude to fire: the very light coals of linen, cotton, some fungi, *&c.* readily catch fire from a spark, and soon burn out; the more dense ones of woods and roots are set on fire more difficultly, and burn more slowly: the coals of the black berry-bearing alder, of the hazel, the willow, and the lime-tree, are said to answer best for the making of gunpowder and other pyrotechnical compositions, perhaps from their being easily inflammable: for the reduction of metallic calces those of the heavier woods, as the oak and the beech, are preferable, these seeming to contain a larger proportion of the phlogistic principle, and that perhaps, in a more fixed state: considered as common fuel, those of the heavy woods give the greatest heat, and require the most plentiful supply of air to keep them burning; those of the light woods preserve a glowing heat, without much draught of air, till the coals themselves are consumed; the bark commonly crackles and flies about in burning, which the coal of the wood itself very seldom does.

Mathematical instrument makers, engravers, *&c.* find charcoal of great use to polish their brass and copper-plates after they have been rubbed clean with powdered pumice-stone. Plates of horn are polishable in the same way, and a gloss may be afterwards given with tripoli.

The coals of different substances are also used as pigments; hence the bone-black, ivory-black, *&c.* of the shops. Most of the paints of this kind, besides their incorruptibility, have the advantage of a full colour, and work freely in all the forms in which powdery pigments are applied; provided they have been carefully prepared, by thoroughly burning the subject in a close vessel, and afterwards grinding the coal into a powder of due fineness. Pieces of charcoal are used also in their entire state for tracing the outlines of drawing *&c.*; in which intention they have an excellence, that their mark is easily wiped out. For these purposes, either the finer pieces of common charcoal are picked out and cut to a proper shape; or the pencils are formed of wood, and afterwards burnt into charcoal in a proper vessel well covered. The artists commonly make choice of the smaller branches of the tree freed from the bark and pith; and the willow and vine

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vine are preferred to all others. This choice is confirmed by the experiments of Dr Lewis who has found that the wood of the trunks of trees produces charcoal of a harder nature than their small twigs or branches; and the hard woods, such as box and guaiacum, produced coals very sensibly harder than the softer woods. Willow he prefers to all others. The shells and stones of fruits yielded coals so hard that they would scarce mark on paper at all; while the coals of the kernels of fruits were quite soft and mellow. The several coals produced by the doctor's experiments were levigated into fine powder, mixed both with gum-water and oil, and applied as paints both thin and thick, and diluted with different degrees of white. All of them, when laid on thick, appeared of a strong full black, nor could it be judged that one was of a finer colour than another; diluted with white, or when spread thin, they had all somewhat of a bluish cast.

Horns and the bones both of fishes and land-animals, gave coals rather glossier and deeper-coloured than vegetables; and which, in general were very hard, so as difficultly, or not at all, to stain paper. Here also the hardness of the coal seemed to depend on that of the subject from whence it was prepared; for silk, woollen, leather, blood, and the fleshy parts of animals, yielded soft coals, some of these differed from others very sensibly in colour: that of ivory is superior to all the rest, and indisputably the finest of all the charcoal blacks. The animal coals had much less of the bluish cast in them than the vegetable, many of them inclining rather to a brown. Charred pit-coal, on the other hand, seemed to have this blueness in a greater degree.

Charcoal is not soluble in any of the acids; but may be dissolved in considerable quantities by a solution of *hepar sulphuris*, to which it communicates a green colour. Melted with colourless fruits or glasses, it gives a pale yellow, dark yellow, reddish, brownish, or blackish colour, acccording as the inflammable matter is in greater or less proportion; the phlogiston, or inflammable matter of the the coal seeming to be the direct tinging substance. When the phlogistic matter is thus diffused through glass, it is no more affected by continued strong fire than charcoal is when excluded from the air.

The vapour of burning charcoal is found to be highly noxious, being no other than *fixed air*. How this affects the animal system is explained under the article Blood.

From some late experiments it appears, that charcoal possesses many extraordinary properties altogether unsuspected by former chemists. It has particularly a great attraction for what is called the *phlogiston*, or rather for any kind of oily matter with which other substances may be sullied; so that it now promises to be very useful in the arts in various ways never thought of before. M. Lowits has found that it is useful in preparing crystals of tartar of a very white colour; and that the marine and nitrous acids are decomposed by being distilled upon it: the red juices of vegetable fruits are discoloured, without losing any of their acidity; brown rancid oils are rendered sweet and clear by agitating them for some days with charcoal in powder; it changes the smell of putrid vegetables to that of a pure volatile alkali, and it produces the same effect on fresh meat. On boiling coals in powder with honey, the pure saccharine parts of the latter are said to be separated, and the honey to become a well-tasted sugar; the purification of real sugar is also said to be facilitated by the same method. Thus also the mother-water of the Prussian alkali and of the tartareous acid are made to crystallize easily; terra foliata tartari may be made white without calcination, by previously distilling the vinegar from coals. Vinegar concentrated by freezing, and distilled from a large proportion of powdered coal, is extremely strong, pure, and fragrant. Corn spirit merely shaken with coal loses its bad flavour; and if honey is added, it becomes a sweet and pleasant liquor. Even when ardent spirits are impregnated with any vegetable oils, the flavour is destroyed in this way: and if the spirit be distilled the residuum is said not to be brown; so that if the distillation is carried too far, no inconvenience ensues. With Peruvian bark, a clear decoction was formed, and the residuum was a salt, in taste like digestive salt. These effects were produced by every kind of coal, whether fossil or charred vegetable substances.

Charcoal has lately been separated from the purest spirit of wine in the process for making ether*; and by M. Lavoisier is supposed to be one of the constituent parts or elements of that very volatile liquid. But the most extraordinary modern discovery concerning this substance is that of Dr Priestley, who has found that several of the metals may be converted into charcoal by passing the steam of spirit of wine over them when red-hot; and this, by way of distinction, he calls the *charcoal of metals*.

* See *Chemistry*, Index.

This surprising discovery was made accidentally, while the Doctor was repeating the experiments by which Mr Lavoisier imagined water might be converted into air. Having transmitted the steam of water thro' a copper tube, on which it had no effect, he was willing to try the effects of that of other fluids; and for this purpose made choice of spirit of wine, having before procured inflammable air by sending the same steam through a red-hot tobacco-pipe. No sooner had the vapour of this fluid, however, touched the red-hot copper, than he was astonished at the rapid production of air from it, which resembled the blowing of a pair of bellows; and before four ounces of the spirit were expended, the tube was found to be perforated in two or three places. In a moment afterwards it was so far destroyed, that it fell to pieces on attempting to remove it from the fire; the inside being filled with a black matter resembling lamp-black. Having now recourse to earthen tubes, the Doctor found that, by melting copper and other metals in them, and transmitting the vapour of spirit of wine in contact with them while in a state of ignition, different substances were formed according to the metals employed. On sending three ounce-measures of spirit of wine over two ounces of copper, the metal lost 28 grains of its weight, and 446 grains of charcoal were procured, chiefly in the form of powder, though some of it was in large flakes several inches long; having separated at once from the surface of the melted metal. These pieces were almost quite black, and bore handling without any danger of being broken. In another experiment, 508 grains of charcoal were obtained from 19 grains of copper; but here the metal had been previously reduced

Charcoal. duced to thin plates, and they were not all converted into charcoal, being something harder, and therefore partially metallic in the middle.

Silver was found to be affected very much as copper had been; but the larger masses of charcoal procured from this metal were much whiter than those from copper. Only a small quantity of charcoal could be procured from lead. Three ounce-measures of spirit of wine and near four ounces of lead, gave only a small quantity of whitish powdery substance, though 58 grains of the lead were missing; but the inside of the glass- tube through which the air was transmitted became very black. The like quantity of spirit of wine sent over 360 grains of melted tin, and produced 26 grains of black dust, the metal not being diminished quite four grains. The vapour of two ounce-measures of spirit of wine, sent over 960 grains of iron-shavings, diminished the metal only two grains; but no charcoal could be collected, though the air was loaded with black particles. The iron had acquired a dark blue colour. Gold was not sensibly changed or diminished in weight; and it not only remained unalterable by the process itself, but effectually protected a tenth-part of its weight of copper from the action of the steam.

Spirit of turpentine was found to answer for the production of this charcoal, as well as spirit of wine; 120 grains of the former being obtained from five of copper by means of the turpentine, notwithstanding a very dense black smoke which issued from the end of the tube during the whole time of the operation. The Doctor observes, indeed, that in all those experiments, where the heat is very great, the minute division and volatility of this charcoal is very extraordinary. Seeing it issue from the end of a tube in a dense black cloud, he endeavoured to collect it in a large glass receiver; but after having given the glass a very thin black coating, not distinguishable in appearance from soot, it issued from the orifice like dense smoke, and appeared to be altogether incoercible, even when several adopters were connected with the receiver, and a tube, from whence it finally issued, plunged deep into water.

It is observed, that charcoal of wood, when fresh made, has a strong attraction for air, and will continue to absorb it for a considerable time; a property which it has in common with several other substances. Dr Priestley made some experiments to ascertain the quantity absorbed. For this purpose, he left in an open dish, on the fourth of September, some charcoal fresh made from dry oak, and weighing 364 grains. Two or three days after it weighed 390 grains; on the 24th of October, 419; and on the 26th of April following it weighed 421 grains. By distillation in an earthen retort it yielded a quantity of air considerably phlogisticated, and then weighed 312 grains, but the retort appeared to have been cracked. On exposing it again to the open air for a whole year, it weighed 371 grains. In another experiment, a quantity of charcoal which had yielded by a strong heat 336 ounce-measures of air, and weighed immediately afterwards 756 grains, increased in three days to 817; and on expelling the air from it was reduced to 711 grains. In all these experiments the air was worse than that of the atmosphere, and a part was fixed air.

It has been generally supposed by chemists, that charcoal was indestructible by any other means than burning in an open fire, though of late it is found totally dissipable and convertible into inflammable air, by the heat of a burning lens *in vacuo*, at least with the assistance of a small quantity of water. By burning in dephlogisticated air, it is found to convert almost the whole of it into fixed air. See AEROLOGY, n° 110—113, 129, 131. From the experiments there related, it is now evident, that charcoal as such, and without any decomposition, is an ingredient in both those aerial fluids, and is indeed the phlogiston of Stahl so long sought in vain. This discovery, however, has not by any means put an end to the disputes betwixt the *Phlogistians* and *Antiphlogistians*, though it certainly ought to have done so, and must assuredly do so in a short time. The experiments of Dr Priestley are not doubted; and charcoal, the gravitating matter of light inflammable air, and *phlogiston*, are allowed to be the same by the Antiphlogistians as well as by the opposite party. "The present controversy (says Mr Higgins) among the philosophers depends upon the following questions: 1. Whether water be or be not composed of dephlogisticated and light inflammable air? 2. Whether or no the condensation of dephlogisticated air, or its union to different bodies, does not depend upon one principle, common to all combustible bodies? or, in other words, whether or no all bodies which burn or calcine, such as sulphur, phosphorus, charcoal, oils, metals, phlogisticated air, &c. contain the matter of light inflammable air as one of their constituent principles? One should suppose, if these substances were composed of two principles, namely a peculiar basis, and the matter of light inflammable air or phlogiston, that it would be possible to resolve them into these principles; more especially when we consider the great attraction of the matter of light inflammable air to fire; but the maintainers of phlogiston have not as yet been able to do this," &c.

*Higgins's Comparati View*, Pre p. 5.

The limits of this work will not allow us to enter on a full discussion of this controversy, nor can we pretend to be able to settle the disputes on the subject. It nevertheless seems somewhat unnatural to call iron, lead, copper, sulphur, phosphorus, &c. simple and unchangeable bodies, or if we please *elements*; as thus the number of elementary bodies might be increased without number, and *water*, which has generally been reckoned a simple one, supposed to be almost the only compound body in nature. It is also certain, that Dr Priestley has made some very striking and apparently decisive experiments on the subject of metals, to which no proper reply has ever been made. In order to see the force of these experiments, however, we must still observe, that, according to the Phlogistians, the calces of metals are reduced, on the addition of charcoal, not only by emitting the dephlogisticated air which adheres to them when in the form of calces, but by the admission of a quantity of the charcoal itself into their substance. This the Antiphlogistians deny; and though they admit the necessity of charcoal in the operation, yet they affirm that it acts only by attracting the dephlogisticated air contained in the calx, with which it forms fixed air; and hence they must say, that in all metallic reductions a quantity of fixed air is produced, equivalent not only to the weight of the charcoal employed, but also to that of the dephlogisticated air con-

Charcoal. contained in the calx. The decisive experiment therefore would be, to expel from a metallic calx all the air it contained, to weigh it exactly in that state, and then observe whether it gained any thing in weight by being reduced to a metal. This, however, has not been done; and the Antiphlogistians complain that their adversaries have not been able to produce a pure metallic calx free from all kind of aerial vapour. But though it is not pretended that any such calx has yet been produced, if the Phlogistians can show the possibility of reducing a calx without the production of fixed air, it would seem to be equally destructive of the antiphlogistic doctrine. This appears to have been done by Dr Priestley in the experiments above alluded to; and it is even doubtful whether he did not obtain the so much desired calx, viz. one perfectly free from air altogether. "I put (says he) upon a piece of broken crucible, which could yield no air, a quantity of minium, *out of which all air* had been extracted; and placing it upon a convenient stand, introduced it into a large receiver filled with inflammable air confined by water. As soon as the minium was dry, by means of the heat thrown upon it, I observed that it became black, and then ran in the form of perfect lead, at the same time that the air diminished at a great rate the water ascending within the receiver. Before this first experiment was concluded, I perceived, that if the phlogiston in inflammable air had any base, it must be very inconsiderable; for the process went on till there was no more room to operate without endangering the receiver; and examining the air that remained, I found that it could not be distinguished from that in which I began the experiment, which was air extracted from iron by oil of vitriol.

"I afterwards carefully expelled, from a quantity of minium, all the phlogiston, and every thing else that could have assumed the form of air, by giving it a red heat when mixed with spirit of nitre; and immediately using it in the manner mentioned above, I reduced 101 ounce-measures of inflammable air to two. To judge of its degree of inflammability, I presented the flame of a small candle to the mouth of a vial filled with it, and observed, that it made 13 separate explosions, though weak ones (stopping the mouth of the phial with my finger after each explosion); when fresh made inflammable air, in the same circumstances, made only 14 explosions, though stronger ones. In this experiment, however, I overlooked one obvious consideration, viz. that water, or any thing soluble in water, might be the basis of inflammable air. All that could be absolutely inferred from the experiment was, that this basis could not be any thing that was capable of subsisting in the form of air. It will be seen, that I afterwards made the experiment with air confined by mercury."

In this experiment it is to be regretted that the Doctor did not inform us whether the weight of his calces was on the whole increased or diminished by the operation. As it stands, though sufficient to overthrow the doctrine of the Antiphlogistians, it is not altogether sufficient to establish that of their adversaries. Mr Higgins, however, though he does not reply to this experiment, gives an account of another from Dr Higgins, which he considers as absolutely decisive against the phlogistians. "Dr Higgins (says he) introduced some pieces of well-burned charcoal into a deep crucible, and covered them over an inch deep with powdered charcoal. Having luted on a cover, he exposed them for two hours to heat sufficient to melt silver; he then placed the crucible in such a manner that the powder might remain red hot for some time after the pieces next the bottom had cooled. This he had done, as the charcoal must imbibe something on cooling, both to supply it with inflammable air, and to prevent a communication with the external air, which the charcoal would otherwise have imbibed.

"One hundred and twenty grains of this charcoal quickly powdered, were well mixed with 7680 grains of litharge, which had been previously fused to separate any uncalcined lead it might contain. The mixture was charged into a coated retort just large enough to contain it; so that the common air must have been nearly secluded. Being then placed in a reverberating furnace, and heat duly applied, it yielded by estimation, after cooling to the mean temperature of the atmosphere, 384 grains of fixable air, at the rate of 0.57 grains to a cubic inch, 8.704 of phlogisticated air, and 0.911 grains of dephlogisticated air, besides 49 grains of water. On breaking the retort, 3888 grains of revived lead were found, besides some vitrified litharge; but not an atom of charcoal was left, nor was there a particle of inflammable air produced. Now, let my reader consider the weight that 3888 grains of lead acquire by its conversion to litharge, and the quantity of inflammable air that 120 grains of charcoal will afford (which, according to Dr Priestley, is about 360 ounce-measures), and he will find, making allowance for the phlogisticated air, that these nearly correspond with the proportion of heavy inflammable air and dephlogisticated air necessary to the formation of fixable air by the electric spark. Hence we may conclude, that not a particle of charcoal entered into the constitution of the revived lead, but must have been wholly converted into fixable air."

To this experiment, however, the Phlogistians will reply, that so far from being decisive on the subject, no conclusion whatever can be drawn from it, on account of its *enormous* inaccuracy. The quantity of matter put into the retort was 7680+120, or 7800 grains, and the whole produce was 3888+384+8.704+0.911+49=4330.615 grains: a deficiency therefore of no less than 3469.385 grains is to be accounted for; and of this we hear not one word; so that we are at liberty to suppose that the vitrified litharge had perforated the retort in such a manner as to admit the fixed and phlogisticated air from without, as Dr Priestley found earthen retorts pervious to air from without; and this, though coated, might by a corrosion of the glass (if it was a glass one) be reduced to a similar situation.

We do not mean that this should be reckoned a formal answer to Dr Higgins's experiment; all we intend here, is to state the arguments fairly on both sides, so that the reader who has not an opportunity of making experiments himself, may be able to judge on which side the truth lies. Dr Priestley informs us, that in his experiment, the calx of lead absorbed a quantity of inflammable air without the extrication of fixed air, or any thing else that could be perceived. Whether or not have we reason to conclude from thence, that

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that the gravitating, ſolid, or coally, part of the inflammable air was received into the calx, and became part of the revived metal? In Dr Higgins's experiment a quantity of elaſtic fluid was produced, and a quantity of lead revived; but we neither know how much of the calx went to this lead, how much the litharge had originally attracted from the air, nor whether the elaſtic fluids were certainly produced; or indeed whether any of them, the ſmall quantity of dephlogiſticated air alone excepted, came from the materials or not. From ſuch a ſtate of the caſe, then, have we reaſon to "conclude, that not a particle of charcoal entered into the conſtitution of the lead?"

We ſhall next conſider an experiment made by Mr Higgins himſelf, and which he likewiſe conſiders as deciſive againſt the Phlogiſtians. "I introduced (ſays he) ſome iron nails, free from ruſt, into ſtrong volatile vitriolic acid; when it ſtood for a few minutes, it acquired a milky appearance, and the ſolution went on without ebullition or extrication of air. On ſtanding for a few hours, the ſolution acquired a darkiſh colour, and a black powder was precipitated. This powder, when collected and waſhed, put on red hot iron, burned partly like ſulphur and partly like charcoal duſt, and the incombuſtible reſiduum was of a purpliſh colour. The filtered ſolution was perfectly neutraliſed, and free from the leaſt ſulphureous pungency. Its taſte was ſtrongly chalybeate, but not ſo diſagreeable as that of the ſolution of iron in the perfect vitriolic acid, or in any of the mineral acids. Nitrous acid dropped into the ſolution inſtantly produced a cloudineſs, which immediately diſappeared without ebullition, though volatile ſulphureous acid was extricated in its utmoſt degree of pungency. The vitriolic, marine, and acetous acids, decompoſed this ſolution, but cauſed no turbidneſs, nor was any inflammable air produced.

*Higgins's Comparative View*, p. 49.

In order to know whether the ſulphur was diſengaged from the volatile ſulphureous acid or the iron, I poured marine acid on the ſame nails, when light inflammable air and hepatic air were copiouſly produced, and likewiſe ſulphur was produced in its crude ſtate. When I uſed vitriolic or the nitrous acid, no ſulphur was produced. I tried different nails, and likewiſe iron-filings, with the ſame reſult. Theſe facts convinced me that the ſulphur came from the iron; but that all ſorts of iron contain ſulphur is what I cannot pretend to know, as I have not tried ſteel, or varieties enough of malleable iron. However, I have ſtrong reaſons to ſuſpect, that ſulpur has more to do in the different properties of iron than we are aware of. That iron ſhould contain ſulphur, notwithſtanding the different proceſſes it muſt neceſſarily undergo before it acquires malleability, conſidering the volatility of ſulphur, points out the force of their attraction to one another; and the ſeparation of this again by volatile ſulphureous acid, ſhows likewiſe the greater attraction of iron to ſulphur and dephlogiſticated air jointly. That volatile ſulphureous acid ſhould diſſolve iron without the extrication of inflammable air or phlogiſton, is a very ſtrong inſtance of the fallacy of the phlogiſtic doctrine. A ſmall quantity of inflammable air is produced, but it is ſo trifling comparatively to what ſhould be produced from the quantity of iron diſſolved, that it is hardly worth noticing; and in my opinion proceeds from a portion of perfect vitriolic acid, which is generally inſeparable from the volatile acid. If volatile vitriolic acid were a compound of phlogiſton, a certain baſis, and dephlogiſticated air, a greater quantity of inflammable air ſhould have been diſengaged during the ſolution of iron in this acid than when the perfect vitriolic acid is uſed. Let us even ſuppoſe volatile ſulphureous acid to be compoſed of the baſis of ſulphur, phlogiſton, and dephlogiſticated air, which is the opinion of all the phlogiſtians, though they differ with reſpect to the modification of theſe three principles; and likewiſe iron to be compoſed of a certain baſis and phlogiſton; I would aſk the Phlogiſtians, What becomes of the phlogiſton of the iron during its ſolution?"

But however much Mr Higgins may be convinced, from this experiment, of the fallacy of the phlogiſtic doctrine, his adverſaries inſtead of being ſilenced, will urge his own experiment againſt himſelf. He owns, that during the ſolution ſomething was ſeparated of a black colour, and which burned like charcoal duſt. Unleſs therefore Mr Higgins ſhall prove the contrary, they will ſay that this was the real *phlogiſton* or *charcoal* which entered into the ſubſtance of the metal; and that it appeared in its native form, becauſe the volatile vitriolic acid had not ſpecific or latent heat ſufficient to convert it into inflammable air. At any rate, it was incumbent on Mr Higgins to have accounted for the coally part of his reſiduum as well as the ſulphureous one; yet he has been at conſiderable pains to deduce the latter from the iron, without ſpeaking a word about the former. Indeed whether he deduced this from the iron or the vitriolic acid, it will make equally againſt him; for his principles do not allow that the volatile vitriolic acid contains any charcoal. That the latter really does ſo, however, appears from an experiment of Dr Prieſtley, in which he reduced a calx of lead by means of vitriolic acid air, the ſame with the vitriolic or volatile ſulphureous acid. It is true, that only a ſmall quantity of metal was then procured; but however ſmall this was, the Antiphlogiſtians do not pretend that metals can be reduced to their metallic ſtate in any quantity, except by the mediation of charcoal.

Thus it appears, that with regard to metals the diſpute is as yet far enough from being decided in favour of the Antiphlogiſtians. Their cauſe is equally doubtful with regard to ſulphur and phoſphorus, both of which Dr Prieſtley has produced by heating vitriolic and phoſphoric acid in inflammable air. Indeed, by ſome experiments on ſulphur, the matter ſeems to be decided againſt them. "Perhaps (ſays Dr Prieſtley) as deciſive a proof as any, of the real production of fixed air from phlogiſton and dephlogiſticated air, may be drawn from the experiments in which I always found a quantity of it when I burned ſulphur in dephlogiſticated air. In one of theſe experiments to which I gave more particular attention, ſix ounce-meaſures and an half of the dephlogiſticated air were reduced to about two ounce-meaſures, and one-fifth of this was fixed air." Now, though the Doctor inferred from this, that fixed air was compoſed of phlogiſton and dephlogiſticated air, on the ſuppoſition of ſulphur containing phlogiſton; yet admitting from other proofs, that fixed air is compoſed of theſe two principles, the experi-



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riment unanswerably proves, that sulphur contains phlogiston or charcoal, though indeed in a very small quantity; but if the sulphur contained none at all, and the dephlogisticated air as little, as the Antiphlogistians would have it, how is it possible that a compound, of which phlogiston makes a part, should result from an union of the two*? Another experiment equally decisive, even with regard to metals, is that quoted from Dr Priestley in the place just referred to (A), where he obtained pure fixed air from a mixture of red precipitate and iron-filings. Now, according to the antiphlogistic doctrine, neither of these materials contained an atom of charcoal or phlogiston; whence then came the phlogiston in the fixed air which issued from the mixture?

* See *Aerology*, n° 111.

Thus the Antiphlogistians seem to be unanswerably refuted with regard to sulphur and metallic substances; for if the two experiments just related be accurate, it is impossible to invalidate them by any argumentation whatever. Their last resource therefore is the decomposition of water: and even here it is evident they have little reason to boast. On this subject, however, we are sorry to observe, that the opinions have been so many, so various, and so fluctuating, that it is not only impossible to say what are the prevailing ones, but even difficult to ascertain what are the sentiments of any individual on the subject. Under the article AEROLOGY, n° 81. we have quoted Dr Priestley as favouring the doctrine of the decomposition of water; and in Mr Higgins's work we find him quoted as opposing it. "Dr Priestley (says he) supposes that the water produced by the condensation of inflammable and dephlogisticated air, is only what was suspended and attached to them in their elastic state, and that their respective gravitating particles form a different compound, namely, the nitrous acid. To ascertain this, he confined his mixture of airs with dry fixed alkali over mercury, in order to abstract from it as much water as possible. Having thus prepared his mixture of airs, he found, after exploding them, that the product of water fell far short of the weight of both airs, and he observed a dense vapour after every explosion, which soon condensed, and adhered in a solid state to the sides of the vessel, which he found afterwards to be the nitrous acid." To this Mr Higgins answers, that the airs ought to have been accurately weighed after abstracting the water from them, when (he supposes) the weight of water produced would have equalled them. This indeed ought to have been done; but Mr Higgins, or some Antiphlogistian, ought to have done so before he decided positively in favour of the opposite doctrine. At any rate, it cannot be pretended, that in any experiment, let the circumstances of it be what they would, the quantity of water produced ever equalled that of the two airs. It is evident, therefore, that till this shall some how or other be cleared up, the matter must remain uncertain. That the purest water we can obtain always contains phlogiston, is what no Phlogistian denies; that it essentially belongs to it is doubtful, though indeed it must be probable, that it does so until experiments show the contrary. Mr Cavendish supposes that *dephlogisticated* air and *dephlogisticated water* may be the same; and indeed this would seem to be almost certain, were it not for a circumstance taken notice of by Mr Higgins, viz. that in the firing of iron in dephlogisticated air the latter appears to be totally absorbed; though it is certain, that a quantity of undecomposed water enters into its composition.

*Comparative View*, p. 3.

How far this circumstance throws any obscurity on the matter the reader must determine. For a more full investigation of the subject, however, we must refer to the article WATER; and in the mean time shall dismiss the article with a few observations on the composition of charcoal.

From the days of Stahl till very lately, the component parts of this substance have been reckoned a certain kind of earth combined with what was called phlogiston. The late experiments of Dr Priestley have shown, that this doctrine is erroneous, and that charcoal is wholly dissipable into vapour. "On the whole (says the translator of Wiegleb's Chemistry), charcoal appears from the experiments of Lavoisier and Barthollet, to be an oil deprived of its inflammable gas. But coal of wood (or common charcoal) likewise contains fixed alkali, which the soot (or the coal of oil) does not, but instead of this exhibits volatile alkali. The fixed alkali of the former proceeds from the plant itself, and this, in the case of soot, is joined with inflammable gas, and forms volatile alkali, the earthy part being left behind, as happens when this latter is prepared from fixed alkali. Genuine charcoal, therefore, consists of this vegetable principle, united with a little fixed alkali and part of the phlogiston that constituted the oil of the plant of which it is made: for some of this principle is carried off, together with the *hydrophloge* (B), in the form of inflammable gas, if distilled in close vessels; but if burned in the open air, the hyrophloge unites with the pure part of the air, and forms water. From these considerations, as well as from the experiments and observations of M. Berthollet, in the Mem. de l'Acad. des Sciences pour 1786, p. 33. *et seq.* it appears, that common charcoal consists of the vegetable principle, some phlogiston, fixed alkali, and no inflammable gas."

On all this, however, we must observe, that it is entirely disproved by the experiments of Dr Priestley, so often quoted, in which it was totally dissipated into inflammable air*. On this occasion indeed he acknowledges, that some very minute particles of ashes were observed, which could not have amounted to a single grain from many pounds of wood. Even these, according to what he observes in the same place, may be supposed to have come from the small quantity of air in the receiver; and it is to be wished that the Doctor would repeat the experiment in one of those perfect vacuums through which the electric fluid cannot be made to pass. From undoubted experiments, however, it appears, that charcoal cannot be decomposed by mere heat; as *in vacuo* it is dissipated into inflammable air; and

* See *Aerology*, n° 129, 130.

(A) See *Encycl.* Vol. I. p. 169. col. 1. where, in lines 18, 19, from the top, read *precipitate* for *charcoal*.

(B) A word used by Mr Wiegleb, as far as we can comprehend the author's meaning, for one of the component parts of water. See his General System of Chemistry, translated by Hopson, p. 39.

and this, on presenting a proper substance to attract the solid part again discovers itself, by its blackness, to be real charcoal. As little does it appear destructible by burning in the open air; for though some ashes are left, it appears probable that those differ from the coal itself in nothing but having a quantity of air attached to them. By far the greatest part of it, even in the common way of burning, is converted into fixed air; and from that it may again be separated by taking the electric spark in that fluid, when it is resolved into very pure dephlogisticated and inflammable air. The same separation may be effected by merely heating iron in fixed air; in which case the dephlogisticated part will unite to the iron, and the coaly part, together with part of the phlogiston of the metal, be converted into inflammable air. From all these, and other considerations, a suspicion is induced, that the matter of charcoal is not different from the element of earth itself; and that, according to the different modifications of this substance, it either appears as coal, ashes, earth of various kinds, or even metals. This receives some confirmation from the following experiments of Mr Watt, related in the 74th volume of the Philosophical Transactions: "I dissolved (says he) magnesia alba, calcareous earth, and minium, in nitrous acid dephlogisticated by boiling, and diluted with proper proportions of water. I made use of glass-retorts coated with clay; and I received the air in glass-vessels, whose mouths were immersed in a glazed earthen bason containing the smallest quantity of water that could be used for the purpose. As soon as the retort was heated a little above the degree of boiling water, the solutions began to distil watery vapours containing nitrous acid. Soon after these vapours ceased, yellow fumes, and, in some of the cases, dark red fumes, began to appear in the neck of the retort; and, at the same time, there was a production of dephlogisticated air, which was greater in quantity from some of these mixtures than from others, but continued in all of them until the substances were reduced to dryness. I found in the receiving water, &c. very near the whole of the nitrous acid used for their solution, but highly phlogisticated, so as to emit nitrous air by the application of heat; and there is reason to believe, that with more precaution the whole might have been obtained. As the quantity of dephlogisticated air produced by these processes did not form a sufficient part of the whole weight to enable me to judge whether any of the real acid entered into the composition of the air I obtained, I ceased to pursue them further, having learned from them the fact, that however much the acid and the earths were dephlogisticated before the solution, the acid always became highly phlogisticated in the process.

"In order to examine whether this phlogiston was furnished by the earths, some dephlogisticated nitrous acid was distilled from minium till no more air or acid came over. More of the same acid was added to the minium as soon as it was cold, and the distillation repeated, which produced the same appearances of red fumes and dephlogisticated air. This operation was repeated a third time on the same minium, without any sensible variation in the phænomena. The process should have been still farther repeated, but the retort broke about the end of the third distillation; the quantity of minium used was 120 grains, and the quantity of nitrous acid added each time was 240 grains, of such strength that it could dissolve half its weight of mercury by means of heat. It appears from this experiment, that unless minium be supposed principally to consist of phlogiston, the source of the phlogiston thus obtained, was either the nitrous acid itself, or the water with which it was diluted; or else that it came through the retort with the light; for the retort was in this case red hot before any air was produced. Yet this latter conclusion does not appear very satisfactory, when it is considered, that in the process wherein the earth made use of was magnesia, the retort was not red hot, or very obscurely so, in any part of the process, and by no means luminous when the yellow and red fumes first made their appearance."



To these experiments, however, the Antiphlogistians will no doubt reply, that there was no phlogiston in the case, and that the nitrous acid was only decomposed; and indeed the decisive experiment here would be, the entire dissipation of a quantity of earth into some kind of air, as may be done with charcoal; but to do this in the way of distillation must be attended with incredible labour, though, as finally deciding this point, it seems to be well worth pursuing.

A pretty strong proof of the identity of metallic calces with charcoal, is their conversion into it in the manner already related. Experiments, however, are yet wanting on the subject; though it seems probable from what Dr Priestley has already done, that they may thus be entirely dissipated into air as well as common charcoal.

CHARDIN, (Sir John) a celebrated traveller, was born at Paris, 1643. His father, who was a jeweller, had him educated in the Protestant religion; after which he travelled into Persia and India. He traded in jewels, and died at London in 1713. The account he wrote of his travels is much esteemed.

CHARENTON, the name of two towns of France, the one upon the Marmaude in the Bourbonnois; the other in the isle of France, near the confluence of the Marne with the Seine.

CHARES the Lydian, a celebrated statuary, was the disciple of Lysippus; and made the famous Colossus of the sun in the city of Rhodes. Flourished 288 years before Christ.

CHARGE, in gunnery, the quantity of powder and ball wherewith a gun is loaded for execution.

The rules for charging large pieces in war are, That the piece be first cleaned or scoured withinside: that the proper quantity of powder be next driven in and rammed down; care, however, being taken, that the powder, in ramming, be not bruised, because that weakens its effect: that a little quantity of paper, hay, lint, or the like, be rammed over it; and that the ball or shot be intruded. If the ball be red hot, a tompion, or trencher of green wood, is to be driven in before it. The common allowance for a charge of powder of a piece of ordnance is half the weight of the ball. In the British Navy, the allowance for 32 pounders is but seven-sixteenths of the weight of the bullet. But a late author is of opinion, that if the powder in all ship-cannon whatever was reduced to one-third weight of the ball, or even less, it would be of considerable advantage, not only by saving ammunition, but by keep-

*Robin's Proposal for increasing the Strength of the Navy.*

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ing the guns cooler and quieter, and at the same time more effectually injuring the vessels of the enemy. With the present allowance of powder the guns are heated, and their tackle and furniture strained; and this only to render the bullets less efficacious: for a bullet which can but just pass through a piece of timber, and loses almost all its motion thereby, has a much better chance of rending and fracturing it, than if it passes through with a much greater velocity.

CHARGE, in heraldry, is applied to the figures represented on the escutcheon, by which the bearers are distinguished from one another; and it is to be observed, that too many charges are not so honorable as fewer.

*CHARGE of Lead*, denotes a quantity of 36 pigs. See PIG.

*To CHARGE* in the military language, is to attack the enemy either with horse or foot.

CHARGE, in law, denotes the instructions given to the grand jury, with respect to the articles of their inquiry, by the judge who presides on the bench.

CHARGE, in law, also signifies a thing done that bindeth him that doeth it; and discharge is the removal of that charge. Lands may be charged in various ways; as by grant of rent out of it, by statutes, judgments, conditions, warranties, &c.

CHARGE of horning, in Scots law. See HORNING.

*CHARGE to enter Heir*, in Scots law, a writing passing under the signet, obtained at the instance of a creditor, either against the heir of his debtor, for fixing upon him the debt as representing the debtor, which is called a general charge; or, against the debtor himself or his heir, for the purpose of vesting him in the right of any heritable subject to which he has made up no title, in order that the creditor may attach that subject for payment of his debt, in the same manner as if his debtor or his heir were legally vested in it by service or otherwise. This last kind is called a *special charge*.

CHARGE, or rather *Overcharge*, in painting is an exaggerated representation of any person; wherein the likeness is preserved, but at the same time ridiculed.

Few painters have the genius necessary to succeed in these charges: the method is, to select and heighten something already amiss in the face, whether by way of defect, or redundancy; thus *v. g.* if Nature have given a man a nose a little larger than ordinary, the painter falls in with her, and makes the nose extravagantly long: or if the nose be naturally too short, in the painting it will be a mere stump; and thus of the other parts.

CHARGED, in heraldry, a shield carrying some impress or figure, is said to be charged therewith; so also, when one bearing, or charge has another figure added upon it, it is properly said to be charged.

CHARGED, in electrical experiments, is when a vial, pane of glass, or other electric substance, properly coated on both sides, has a quantity of electricity communicated to it; in which case the one side is always electrified positively, and the other negatively.

CHARIOT, a half coach, having only a seat behind, with a stool before. See COACH.

The chariots of the ancients, chiefly used in war, were called by the several names *bigæ*, *trigæ*, &c. according to the number of horses applied to draw them. Every chariot carried two men, who were probably the warrior and the charioteer; and we read of several men of note and valour employed in driving the chariot. When the warriors came to encounter in close fight; they alighted out of the chariot, and fought on foot; but when they were weary, which often happened by reason of their armour, they retired into their chariot, and thence annoyed their enemies with darts and missive weapons. These chariots were made so strong, that they lasted for several generations.

Besides this sort, we find frequent mention of the *currus falcati*, or those charriots armed with hooks, or scythes, with which whole ranks of soldiers were cut off together, if they had not the art of avoiding the danger; these were not only used by the Persians, Syrians, Egyptians, *&c.* but we find them among the ancient Britons; and notwithstanding the imperfect state of some of the most necessary arts among that nation before the invasion of the Romans, it is certain that they had war-chariots in great abundance. By the Greek and Roman historians, these chariots are described by the six following names; *viz* Benna, Petoritum, Currus or Carrus Covinus, Essedum, and Rheda The benna seems to have been a chariot designed rather for travelling than war. It contained two persons, who were called *combennones*, from their sitting together in the same machine. The petoritum seems to have been a larger kind of chariot than the benna; and is thought to have derived its name from the British word *pedwar*, signifying *four*; this kind of carriage having four wheels. The carrus or currus was the common cart or waggon. This kind of chariot was used by the ancient Britons, in times of peace, for the purposes of agriculture and merchandise; and in times of war, for carrying their baggage, and wives and children, who commonly followed the armies of all the Celtic nations. The covinus was a war-chariot, and a very terrible instrument of destruction; being armed with sharp scythes and hooks for cutting and tearing all who were so unhappy as to come within its reach. This kind of chariot was made very slight, and had few or no men in it besides the charioteer; being designed to drive with great force and rapidity, and to do execution chiefly with its hooks and scythes. The essedum and rheda were also war-chariots, probably of a large size, and stronger made than the covinus, designed for containing a charioteer for driving it, and one or two warriors for fighting. The far greatest number of the British war-chariots seem to have been of this kind. These chariots, as already observed, were to be found in great numbers among the Britons; insomuch that Cæsar relates that Cassibelanus, after dismissing all his other forces, retained no fewer than 4000 of these war-chariots about his person. The same author relates, that, by continual experience, they had at last arrived at such perfection, in the management of their chariots, that "in the most steep and difficult places they could stop their horses upon full stretch, turn them which way they pleased, run along the pole, rest on the harness, and throw themselves back into their chariots, with incredible dexterity."

CHARIOTS, in the heathen mythology, were sometimes consecrated to the sun; and the scripture observes, that Josiah burnt those which had been offered to the sun by the king's prodeceffors. This supersti-

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tious custom was an imitation of the heathens, and principally of the Persians, who had horses and chariots consecrated in honour of the sun. Herodotus, Xenophon, and Quintus Curtius, speak of white chariots crowned, which were consecrated to the sun, among the Persians, which in their ceremonies were drawn by white horses consecrated to the same luminary.

*Triumphal CHARIOT*, was one of the principal ornaments of the Roman celebration of a victory.

The Roman triumphal chariot was generally made of ivory, round like a tower, or rather of a cylindrical figure; it was sometimes gilt at the top, and ornamented with crowns, and to represent a victory more naturally, they used to stain it with blood. It was usually drawn by four white horses; but oftentimes by lions, elephants, tygers, bears, leopards, dogs, &c.

CHARISIA, in the heathen theology, a wake, or night-festival, instituted in honour of the graces. It continued the whole night, most of which time was spent in dancing; after which, cakes made of yellow flour mixed with honey, and other sweetmeats, were distributed among the assistants.—Charisia is also sometimes used to signify the sweetmeats used on such occasions.

CHARISIUS, in the heathen theology, a surname given to Jupiter. The word is derived from χαρις, *gratia*, "grace" or "favour;" he being the God by whose influence men obtain the favour and affection of one another. On which account the Greeks used at their meals to make a libation of a cup to Jupiter Charisius.

CHARISTIA, a festival of the ancient Romans, celebrated in the month of February, wherein the relations by blood and marriage met, in order to preserve a good correspondence; and that if there happened to be any difference among them, it might be the more easily accommodated, by the good humour and mirth of the entertainment. *Ovid. Fast.* i. 617.

CHARISTICARY, commendatory, or donatory, a person to whom is given the enjoyment of the revenues of a monastery, hospital, or benefice.

The charisticaries among the Greeks, were a kind of donatories, or commendatories, who enjoyed all the revenues of hospitals and monasteries, without giving an account thereof to any person—The original of this abuse is referred to the Iconoclastæ, particularly Constantine, Copronymus, the avowed enemy of the monks, whose monasteries he gave away to strangers. In after times, the emperors and patriarchs gave many to people of quality, not by way of gift, to reap any temporal advantage from them; but to repair, beautify, and patronize them. At length avarice crept in, and those in good condition were given away, especially such as were rich; and at last they were all given away, rich and poor, those of men and of women, and that to laymen and married men.

CHARITY, among divines, one of the three grand theological virtues, consisting in the love of God and of our neighbour, or the habit and disposition of loving God with all our heart, and our neighbour as ourselves.

CHARITY is also used for the effect of a moral virtue, which consists in supplying the necessities of others, whether with money, counsel, assistance, or the like.



As pecuniary relief is generally the most efficacious, and at the same time that from which we are most apt to excuse ourselves, this branch of the duty merits particular illustration; and a better cannot be offered than what is contained in the following extracts (if we may be permitted to make them) from the elegant *Moral System* of Archdeacon *Paley*.

Whether pity be an instinct or a habit, it is in fact a property of our nature, which God appointed: and the final cause for which it was appointed, is to afford to the miserable, in the compassion of their fellow creatures, a remedy for those inequalities and distresses which God foresaw that many must be exposed to, under every general rule for the distribution of property.

The Christian scriptures are more copious and explicit upon this duty than almost any other. The description which Christ has left us of the proceedings of the last day, establishes the obligation of bounty beyond controversy. When the Son of Man shall come in his glory, and all the holy angels with him, then shall he sit upon the throne of his glory, and before him shall be gathered all nations; and he shall separate them one from another. Then shall the king say unto them on his right hand, Come ye blessed of my father, inherit the kingdom prepared for you from the foundation of the world: For I was an hungered, and ye gave me meat; I was thirsty, and ye gave me drink; I was a stranger, and ye took me in; naked, and ye clothed me; I was sick, and ye visited me; I was in prison, and ye came unto me. And inasmuch as ye have done it to one of the least of these my brethren, ye have done it unto me." It is not necessary to understand this passage as a literal account of what will actually pass on that day. Supposing it only a scenical description of the rules and principles by which the Supreme Arbiter of our destiny will regulate his decisions, it conveys the same lesson to us; it equally demonstrates of how great value and importance these duties in the sight of God are, and what stress will be laid upon them. The apostles also describe this virtue as propitiating the divine favour in an eminent degree. And these recommendations have produced their effect. It does not appear that, before the times of Christianity, an infirmary, hospital, or public charity of any kind, existed in the world; whereas most countries in Christendom have long abounded with these institutions. To which may be added, that a spirit of private liberality seems to flourish amidst the decay of many other virtues: not to mention the legal provision for the poor, which obtains in some countries, and which was unknown and unthought of by the most polished nations of antiquity.

St Paul adds upon the subject an excellent direction; and which is practicable by all who have any thing to give. "Upon the first day of the week (or any other stated time) let every one of you lay by in store, as God hath prospered him." By which the apostle may be understood to recommend what is the very thing wanting with most men, *the being charitable upon a plan*; that is, from a deliberate comparison of our fortunes with the reasonable expences and expectations of our families, to compute what we can spare, and to lay by so much for charitable purposes, in some mode or other. The mode will be a consideration afterwards.

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Charity.

The effect, which Christianity produced upon some of its converts, was such as might be looked for from a divine religion coming with full force and miraculous evidence upon the consciences of mankind. It overwhelmed all worldly considerations in the expectation of a more important existence. "And the multitude of them that believed were of one heart and of one soul; neither said any of them that aught of the things which he possessed, was his own; but they had all things in common.—Neither was there any among them that lacked; for as many as were possessors of lands or houses sold them, and brought the prices of the things that were sold, and laid them down at the apostle's feet; and distribution was made unto every man, according as he had need." Acts iv. 32.

Nevertheless, this community of goods, however it manifested the sincere zeal of the primitive Christians, is no precedent for our imitation. It was confined to the church at Jerusalem; continued not long there; was never enjoined upon any (Acts v. 4.); and, although it might suit with the particular circumstances of a small and select society, is altogether impracticable in a large and mixed community.

The conduct of the apostles upon the occasion deserves to be noticed. Their followers laid down their fortunes at their feet: but so far were they from taking advantage of this unlimited confidence to enrich themselves or establish their authority, that they soon after got rid of this business as inconsistent with the main object of their mission, and transferred the custody and management of the public funds to deacons, elected to that office by the people at large. (Acts vi.)

There are three kinds of charity, our author observes, which prefer a claim to attention.

1. The first, and apparently one of the best, is to give stated and considerable sums, by way of pension or annuity to individuals or families, with whose behaviour and distress we ourselves are acquainted. In speaking of considerable sums, it is meant only, that five pounds, or any other sum, given at once, or divided amongst five or fewer families, will do more good than the same sum distributed amongst a greater number in shillings or half crowns; and that, because it is more likely to be properly applied by the persons who receive it. A poor fellow, who can find no better use for a shilling than to drink his benefactor's health, and purchase half an hour's recreation for himself, would hardly break into a guinea for any such purpose, or be so improvident as not to lay it by for an occasion of importance, for his rent, his clothing, fuel, or stock of winter's provision. It is a still greater recommendation of this kind of charity, that pensions and annuities, which are paid regularly, and can be expected at the time, are the only way by which we can prevent one part of a poor man's sufferings, the dread of want.

2. But as this kind of charity supposes that proper objects of such expensive benefactions fall within our private knowledge and observation, which does not happen to all, a second method of doing good, which is in every one's power who has the money to spare, is by subscription to public charities. Public charities admit of this argument in their favour, that your money goes farther towards attaining the end for which it is given, than it can do by any private and separate beneficence. A guinea, for example, contributed to an infirmary, becomes the means of providing one patient, at least, with a physician, surgeon, apothecary; with medicine, diet, lodging, and suitable attendance; which is not the tenth part of what the same assistance, if it could be procured at all, would cost to a sick person or family in any other situation.

3. The last, and, compared with the former, the lowest exertion of benevolence, is the relief of beggars. Nevertheless, the indiscriminate rejection of all who implore our alms in this way, is by no means approved. Some may perish by such a conduct. Men are sometimes overtaken by distress, for which all other relief would come too late. Besides which, resolutions of this kind compel us to offer such violence to our humanity, as may go near, in a little while, to suffocate the principle itself; which is a very serious consideration. A good man, if he do not surrender himself to his feelings without reserve, will at least lend an ear to importunities which come accompanied with outward attestations of distress; and after a patient hearing of the complaint, will direct himself by the circumstances and credibility of the account that he receives.

There are other species of charity well contrived to make the money expended *go far*; such as keeping down the price of fuel or provision in case of a monopoly or temporary scarcity, by purchasing the articles at the best market, and retailing them at prime cost, or at a small loss; or the adding a bounty to a particular species of labour, when the price is accidentally depressed.

The proprietors of large estates have it in their power to facilitate the maintenance, and thereby encourage the establishment of families (which is one of the noblest purposes to which the rich and great can convert their endeavours), by building cottages, splitting farms, erecting manufactures, cultivating wastes, embanking the sea, draining marshes, and other expedients, which the situation of each estate points out. If the profits of these undertakings do not repay the expence, let the authors of them place the difference to the account of charity. It is true of almost all such projects, that the public is a gainer by them, whatever the owner be. And where the loss can be spared, this consideration is sufficient.

It is become a question of some importance, Under what circumstances works of charity ought to be done in private, and when they may be made public without detracting from the merit of the action; if indeed they ever may, the Author of our religion having delivered a rule upon this subject, which seems to enjoin universal secrecy. "When thou doest alms, let not thy left hand know what thy right hand doth; that thy alms may be in secret, and thy Father which seeth in secret, himself shall reward thee openly." (Matth. vi. 3, 4.) From the preamble to this prohibition, it is plain that our Saviour's sole design was to forbid *ostentation*, and all publishing of good works which proceeds from that motive. Take heed that ye do not your alms before men, *to be seen of them*; otherwise ye have no reward of your Father, which is in heaven: therefore, when thou doest thy alms, do not sound a trumpet before thee, as the hypocrites do in the synagogues and in the streets, *that they may have glory of men*.

Charity. *men*. Verily I ſay unto thee, they have their reward," v. 2. There are motives for the doing our alms in public beſide thoſe of oſtentation; with which therefore our Saviour's rule has no concern; ſuch as to teſtify our approbation of ſome particular ſpecies of charity, and to recommend it to others; to take off the prejudice which the want, or, which is the ſame thing, the ſuppreſſion of our name in the liſt of contributors, might excite againſt the charity or againſt ourſelves. And, ſo long as theſe motives are free from any mixture of vanity, they are in no danger of invading our Savour's prohibition: they rather ſeem to comply with another direction which he has left us: "Let your light ſo ſhine before men, that they may ſee your good works, and glorify your father which is in heaven." If it be neceſſary to propoſe a preciſe diſtinction upon the ſubject, there can be none better than the following: When our bounty is beyond our fortune or ſtation, that is, when it is more than could be expected from us, our charity ſhould be private, if privacy be practicable; when it is not more than might be expected, it may be public: for we cannot hope to influence others to the imitation of extraordinary generoſity, and therefore want, in the former caſe, the only juſtifiable reaſon for making it public.

The pretences by which men excuſe themſelves from giving to the poor, are various; as,

1. "That they have nothing to ſpare;" i. e. nothing, for which they have not ſome other uſe; nothing which their plan of expence, together with the ſavings they have reſolved to lay by, will not exhauſt: never reflecting whether it be in their power, or that it is their duty, to retrench their expences, and contract their plan, "that they may have to give to them that need;" or rather that this ought to have been part of their plan originally.

2. "That they have families of their own, and that charity begins at home." A father is no doubt bound to adjuſt his œconomy with a view to the reaſonable demands of his family upon his fortune; and until a ſufficiency for theſe is acquired, or in due time probably will be acquired (for in human affairs probability is enough), he is juſtified in declining *expenſive* liberality; for to take from thoſe who want, in order to give to thoſe who want, adds nothing to the ſtock of public happineſs. Thus far, therefore, and no farther, the plea in queſtion, is an excuſe for parſimony, and an anſwer to thoſe who ſolicit our bounty.

3. "That charity does not conſiſt in giving money, but in benevolence, philanthropy, love to all mankind, goodneſs of heart," &c. Hear St James: "If a brother or ſiſter be naked, and deſtitute of daily food, and one of you ſay unto them, depart in peace, be ye warmed and filled, notwithſtanding *ye give them not thoſe things which are needful to the body*, what doth it profit?" (James ii. 15, 16.)

4. "That giving to the poor is not mentioned in St Paul's deſcription of charity, in the 13th chapter of his firſt epiſtle to the Corinthians." This is not a deſcription of charity, but of good nature; and it is not neceſſary that every duty be mentioned in every place.

5. "That they pay the poor-rates." They might as well allege that they pay their debts; for the poor have the ſame right to that proportion of a man's property, which the laws aſſign them, that the man himſelf has to the remainder. Charity.

6. "That they employ many poor perſons:"—for their own ſake, not the poor's—otherwiſe it is a good plea.

7. "That the poor do not ſuffer ſo much as we imagine; that education and habit have reconciled them to the evils of their condition, and make them eaſy under it." Habit can never reconcile human nature to the extremities of cold, hunger, and thirſt, any more than it can reconcile the hand to the touch of a red-hot iron: beſides, the queſtion is not, how unhappy any one is, but how much more happy we can make him.

8. "That theſe people, give them what you will, will never thank you, or think of you for it." In the firſt place, this is not true: in the ſecond place, it was not for the ſake of their thanks that you relieved them.

9. That we are ſo liable to be impoſed upon." If a due enquiry be made, our motive and merit is the ſame: beſide that, the diſtreſs is generally real, whatever has been the cauſe of it.

10. "That they ſhould apply to their pariſhes." This is not always practicable: to which we may add, that there are many requiſites to a comfortable ſubſiſtence, which pariſh-relief does not always ſupply; and that there are ſome who would ſuffer almoſt as much from receiving pariſh-relief as by the want of it: and laſtly, that there are many modes of charity, to which this anſwer does not relate at all.

11. "That giving money encourages idleneſs and vagrancy." This is true only of injudicious and indiſcriminate generoſity.

12. "That we have too many objects of charity at home to beſtow any thing upon ſtrangers; ſo that there are other charities which are more uſeful, or ſtand in greater need." The value of this excuſe depends entirely upon the *fact*, whether we actually relieve thoſe neighbouring objects, and contribute to thoſe other charities.

Beſides all theſe excuſes, pride, or prudery, or delicacy, or love of eaſe, keep one half of the world out of the way of obſerving what the other half ſuffer.

*Charity Schools*, are ſchools erected and maintained in various pariſhes by the voluntary contributions of the inhabitants, for teaching poor children to read, write, and other neceſſary parts of education. See School.

*Brothers of Charity*, a ſort of religious hoſpitallers, founded about the year 1297, ſince denominated *Billetins*. They took the third order of St Francis, and the ſcapulary, making three uſual vows, but without begging.

*Brothers of Charity*, alſo denote an order of hoſpitallers ſtill ſubſiſting in Romiſh countries, whoſe buſineſs is to attend the ſick poor, and miniſter to them both ſpiritual and temporal ſuccour.

They are all laymen, except a few prieſts, for adminiſtering the ſacraments to the ſick in their hoſpitals. The brothers of charity uſually cultivate botany, pharmacy, ſurgery, and chemiſtry, which they practiſe with ſucceſs.

They were firſt founded at Granada, by St John de

Dieu; and a second establishment was made at Madrid in the year 1553: the order was confirmed by Gregory XIII. in 1572: Gregory XIV. forbad them to take holy orders; but by leave of Paul V. in 1609, a few of the brothers might be admitted to orders. In 1619 they were exempted from the jurisdiction of the bishop. Those of Spain are separated from the rest; and they, as well as the brothers of France, Germany, Poland, and Italy, have their distinct generals, who, reside at Rome. They were first introduced into France by Mary of Medicis in 1601, and have since built a fine hospital in the Fauxbourg St Germain.

*Charity of St Hippolitus*, a religious congregation founded about the end of the 14th century, by one Bernardin Alvarez, a Mexican, in honour of St Hippolitus the martyr, patron of the city of Mexico; and approved by Pope Gregory XIII.

*Charity of our Lady*, in church-history, a religious order in France, which though charity was the principal motive of their union, grew in length of time so disorderly and irregular, that their order dwindled, and at last became extinct.

There is still at Paris a religious order of women, called *nuns hospitallers of the charity of our lady*. The religious of this hospital are by vow obliged to administer to the necessities of the poor and the sick, but those only women.

CHARLATAN, or Charletan, signifies an empiric or quack, who retails his medicines on a public stage, and draws people about him with his buffooneries, feats of activity, &c. The word according to Calepine, comes from the Italian *ceretano*; of *Cæretum*, a town near Spoletto in Italy, where these impostors are said to have first risen. Menage derives it from *ciarlatano*, and that from *circulatorius*, of *circulator*, a quack.

CHARLEMAGNE, or Charles the I. king of France by succession, and emperor of the west by conquest in 800, (which laid the foundation of the dynasty of the western Franks, who ruled the empire 472 years till the time of Radolphus Aufpurgensis, the founder of the house of Austria). Charlemagne was as illustrious in the cabinet as in the field; and though he could not write his name, was the patron of men of letters, the restorer of learning, and a wise legislator: he wanted only the virtue of humanity to render him the most accomplished of men; but when we read of his beheading 4500 Saxons, solely for their loyalty to their prince, in opposing his conquests, we cannot think he merits the extravagant encomiums bestowed on him by some historians. He died in 814, in the 74th year of his age, and 47th of his reign.

France had nine sovereigns of his name, of whom Charles V. merited the title of *the wise* (crowned in 1364, died in 1380): and charles VIII. signalized himself in the field by rapid victories in Italy; crowned 1483, died in 1498. The rest do not deserve particular mention in this place. See *(History of)* France.

CHARLEMONT, a town of the province of Namur in the Austrian Netherlands, about 18 miles south of Namur. E. Long. 4. 40. N. Lat. 50. 10.

Charlemont is also the name of a town of Ireland, situated on the river Blackwater, in the county of Armagh, and province of Ulster, about six miles south-east of Dungannon. W. Long. 6. 50. N. Lat. 50. 16.



CHARLEROY, a strong town in the province of Namur, in the Austrian Netherlands, situated on the river Sambre, about 19 miles west of Namur. E. Long. 4. 20. N. Lat. 50. 30.

CHARLES Martel, a renowned conqueror in the early annals of France. He deposed and restored Chilperic king of France; and had the entire government of the kingdom, once with the title of *mayor of the palace* and afterwards as *duke of France*; but he would not accept the crown. He died, regretted, in 741.

*Charles le Gros*, emperor of the west in 881, king of Italy and Suabia, memorable for his reverse of fortune, being dethroned at a diet held near Mentz, by the French, the Italians, and the Germans, in 887: after which he was obliged to subsist on the bounty of the archbishop of Mentz. He died in 888.

Charles V. (emperor and king of Spain), was son of Philip I. archduke of Austria, and of Jane queen of Castile. He was born at Ghent, February 24, 1500. and succeeded to the crown of Spain in 1517. Two years afterwards he was chosen emperor at Francfort after the death of Maximilian his grandfather. He was a great warrior and politician; and his ambition was not satisfied with the many kingdoms and provinces he possessed; for he is supposed, with reason, to have aspired at universal empire. He is said to have fought 60 battles in most of which he was victorious. He took the king of France (Francis I.) prisoner, and sold him his liberty on very hard terms; yet afterwards, when the people of Ghent revolted, he asked leave to pass through his dominions; and though the generous king thus had him in his power, and had an opportunity of revenging his ill-treatment, yet he received and attended him with all pomp and magnificence. He sacked Rome, and took the Pope prisoner; and the cruelties which his army exercised there are said to have exceeded those of the northern barbarians. Yet the pious emperor went into mourning on account of this conquest: forbad the ringing of bells; commanded processions to be made, and prayers to be offered up for the deliverance of the Pope his prisoner; yet did not inflict the least punishment on those who treated the holy father and the holy see with such inhumanity. He is accused by some Romish writers of favouring the Lutheran principles, which he might easily have extirpated. But the truth is, he found his account in the divisions which that sect occasioned; and he for ever made his advantage of them, sometimes against the Pope, sometimes against France, and at other times against the empire itself. He was a great traveller, and made 50 different journeys into Germany, Spain, Italy, Flanders, France, England, and Africa. Though he had been successful in many unjust enterprises, yet his last attempt on Metz, which he besieged with an army of 100,000 men, was very just and very unsuccessful.

Vexed at the reverse of fortune which seemed to attend his latter days, and oppressed by sickness, which unfitted him any longer from holding the reigns of government with steadiness, or to guide them with address,

dress, he resigned his dominions to his brother Ferdinand and his son Philip; and retreated to the monastery of St Justus near Placentia in Estramadura.

When Charles entered this retreat, he formed such a plan of life for himself as would have suited a private gentleman of moderate fortune. His table was neat, but plain; his domestics few; his intercourse with them familiar; all the cumbersome and ceremonious forms of attendance on his person were entirely abolished, as destructive of that social ease and tranquillity which he courted in order to sooth the remainder of his days. As the mildness of the climate, together with his deliverance from the burdens and cares of government procured him at first a considerable remission from the acute pains of the gout, with which he had been long tormented, he enjoyed perhaps more complete satisfaction in this humble solitude than all his grandeur had ever yielded him. The ambitious thoughts and projects which had so long engrossed and disquieted him, were quite effaced from his mind. Far from taking any part in the political transactions of the princes of Europe, he restrained his curiosity even from an enquiry concerning them; and he seemed to view the busy scene which he had abandoned with all the contempt and indifference arising from his thorough experience of its vanity, as well as from the pleasing reflection of having disentangled himself from its cares.

Other amusements, and other objects, now occupied him. Sometimes he cultivated the plants in his garden with his own hand; sometimes he rode out to the neighbouring wood on a little horse, the only one that he kept, attended by a single servant on foot. When his infirmities confined him to his apartment, which often happened, and deprived him of these more active recreations, he either admitted a few gentlemen who resided near the monastery to visit him, and entertained them familiarly at his table; or he employed himself in studying mechanical principles, and in forming curious works of mechanism, of which he had always been remarkably fond, and to which his genius was peculiarly turned. With this view he had engaged Turriano, one of the most ingenious artists of that age, to accompany him in his retreat. He laboured together with him in framing models of the most useful machines, as well as in making experiments with regard to their respective powers; and it was not seldom that the ideas of the monarch assisted or perfected the inventions of the artist. He relieved his mind at intervals with slighter and more fantastic works of mechanism, in fashioning puppets, which, by the structure of internal springs, mimicked the gestures and actions of men, to the no small astonishment of the ignorant monks, who, beholding movements which they could not comprehend, sometimes distrusted their own senses, and sometimes suspected Charles and Turriano of being in compact with invisible powers. He was particularly curious with regard to the construction of clocks and watches; and having found, after repeated trials, that he could not bring any two of them to go exactly alike, he reflected, it is said, with a mixture of surprise as well as regret on his own folly, in having bestowed so much time and labour in the more vain attempt of bringing mankind to a precise uniformity of sentiment concerning the intricate and mysterious doctrines of religion.

But in what manner soever Charles disposed of the rest of his time, he constantly reserved a considerable portion of it for religious exercises. He regularly attended divine service in the chapel of the monastery every morning and evening; he took great pleasure in reading books of devotion, particularly the works of St Augustine and St Bernard; and conversed much with his confessor, and the prior of the monastery, on pious subjects. Thus did Charles pass the first year of his retreat in a manner not unbecoming a man perfectly disengaged from the affairs of this present life, and standing on the confines of a future world, either in innocent amusements which soothed his pains, and relieved a mind worn out with excessive application to business; or in devout occupations, which he deemed necessary in preparing for another state.

But, about six months before his death, the gout, after a longer intermission than usual, returned with a proportional increase of violence. His shattered constitution had not strength enough remaining to withstand such a shock. It enfeebled his mind as much as his body; and from this period we hardly discern any traces of that sound and masculine understanding which distinguished Charles among his cotemporaries. An illiberal and timid superstition depressed his spirit. He had no relish for amusements of any kind. He endeavoured to conform, in his manner of living, to all the rigour of monastic austerity. He desired no other society than that of monks, and was almost continually employed in chanting with them the hymns of the missal. As an expiation for his sins, he gave himself the discipline in secret with such severity, that the whip of cords which he employed as the instrument of his punishment, was found, after his decease, tinged with his blood. Nor was he satisfied with these acts of mortification, which, however severe, were not unexampled. The timorous and distrustful solicitude which always accompanies superstition, still continued to disquiet him, and depreciating all that he had done, prompted him to aim at something extraordinary, at some new and singular act of piety, that would display his zeal, and merit the favour of heaven. The act on which he fixed was as wild and uncommon as any that superstition ever suggested to a disordered fancy. He resolved to celebrate his own obsequies before his death. He ordered his tomb to be erected in the chapel of the monastery. His domestics marched thither in funeral procession, with black tapers in their hands. He himself followed in his shroud. He was laid in his coffin with much solemnity: The service for the dead was chanted; and Charles joined in the prayers which were offered up for the rest of his soul, mingled his tears with those which his attendants shed, as if they had been celebrating a real funeral. The ceremony closed with sprinkling holy water on the coffin in the usual form, and, all the assistants retiring, the doors of the chapel were shut. Then Charles rose out of the coffin, and withdrew to his apartment, full of those awful sentiments which such a singular solemnity was calculated to inspire. But either the fatiguing length of the ceremony, Charles.

remony, or the impression which this image of death left on his mind, affected him so much, that next day he was seized with a fever. His feeble frame could not long resist its violence; and he expired on the 21st of September, after a life of 58 years six months and 21 days.

CHARLES I. } Kings of Britain. See BRITAIN,
CHARLES II. } n° 49,——254.

CHARLES XII. king of Sweden, was born in 1682. By his father's will, the administration was lodged in the hands of the queen-dowager Eleonora with five senators till the young prince was 18: but he was declared major at 15, by the states convened at Stockholm. The beginning of his administration raised no favourable ideas of him, as he was thought both by Swedes and foreigners to be a person of mean capacity. But the difficulties that gathered round him soon afforded him an opportunity to display his real character. Three powerful princes, Frederic king of Denmark, Augustus king of Poland and elector of Saxony, and Peter the Great czar of Muscovy, presuming on his youth, conspired his ruin almost at the same instant. Their measures alarming the council, they were for diverting the storm by negociations; but Charles, with a grave resolution that astonished them, said, "I am resolved never to enter upon an unjust "war, nor to put an end to a just one but by the "destruction of my enemies. My resolution is fix-"ed: I will attack the first who shall declare against "me; and when I have conquered him, I may hope "to strike a terror into the rest." The old counsellors received his orders with admiration; and were still more surprised when they saw him on a sudden renounce all the enjoyments of a court, reduce his table to the utmost frugality, dress like a common soldier, and, full of the ideas of Alexander and Cæsar, propose those two conquerors for his models in every thing but their vices. The king of Denmark began by ravaging the territories of the duke of Holstein. Upon this Charles carried the war into the heart of Denmark; and made such a progress, that the king of Denmark thought it best to accept of peace, which was concluded in 1700. He next resolved to advance against the king of Poland, who had blocked up Riga. He had no sooner given orders for his troops to go into winter-quarters, than he received advice that Narva, where count Horne was governor, was besieged by an army of 100,000 Muscovites. This made him alter his measures, and move toward the Czar; and at Narva he gained a surprising victory, which cost him not above 2000 men killed and wounded. The Muscovites were forced to retire from the provinces they had invaded. He pursued his conquests, till he penetrated as far as where the diet of Poland was sitting; when he made them declare the throne of Poland vacant, and elect Stanislaus their king: then making himself master of Saxony, he obliged Augustus himself to renounce the crown of Poland, and acknowledge Stanislaus by a letter of congratulation on his accession. All Europe was surprised with the expeditious finishing of this great negociation, but more at the disinterestedness of the king of Sweden, who satisfied himself with the bare reputation of this victory, without demanding an inch of ground for enlarging his dominions. After thus reducing the king of Denmark to peace, placing a new king on the throne of Poland, having humbled the emperor of Germany, and protected the Lutheran religion, Charles prepared to penetrate into Muscovy in order to dethrone the Czar. He quickly obliged the Muscovites to abandon Poland, pursued them into their own country, and won several battles over them. The Czar disposed to peace, ventured to make some proposals: Charles only answered, "I will treat with "the Czar at Moscow." When this haughty answer was brought to Peter, he said, "My brother Charles "still affects to act the Alexander, but I flatter my-"self he will not in me find a Darius." The event justified him: for the Muscovites, already beaten into discipline, and under a prince of such talents as Peter, entirely destroyed the Swedish army at the memorable battle of Pultowa, July 8, 1709; on which decisive day, Charles lost the fruits of nine years labour, and of almost 100 battles! The king, with a small troop, pursued by the Muscovites, passed the Boristhenes to Oczakow in the Turkish territories: and from thence through desart countries, arrived at Bender; where the Sultan, when informed of his arrival, sent orders for accommodating him in the best manner, and appointed him a guard. Near Bender Charles built a house, and intrenched himself; and had with him 1800 men, who were all clothed and fed, with their horses, at the expence of the Grand Signior. Here he formed a design of turning the Ottoman arms upon his enemies; and is said to have had a promise from the Vizir of being sent into Muscovy with 200,000 men. While he remained here, he insensibly acquired a taste for books: he read the tragedies of Corneille and Racine, with the works of Despreaux, whose satires he relished, but did not much admire his other works. When he read that passage in which the author represents Alexander as a fool and a madman, he tore out the leaf. He would sometimes play at chess: but when he recovered of his wounds, he renewed his fatigues in exercising his men; he tired three horses a day; and those who courted his favour were all day in their boots. To dispose the Ottoman Porte to this war, he detached about 800 Poles and Cosaques of his retinue, with orders to pass the Neister, that runs by Bender, and to observe what passed on the frontiers of Poland. The Muscovite troops, dispersed in those quarters, fell immediately upon this little company, and pursued them even to the territories of the Grand Signior. This was what the king expected. His ministers at the Porte excited the Turks to vengeance; but the Czar's money removed all difficulties, and Charles found himself in a manner prisoner among the Tartars. He imagined the Sultan was ignorant of the intrigues of his Grand Vizir. Poniatosky undertook to make his complaints to the Grand Signior. The Sultan, in answer, some days after, sent Charles five Arabian horses, one of which was covered with a saddle and housing of great riches; with an obliging letter, but conceived in such general terms, as gave reason to suspect that the minister had done nothing without the Sultan's consent: Charles therefore refused them. Poniatosky had the courage to form a design of deposing the Grand Vizir; who

Charles. who accordingly was deprived of his dignity and wealth, and banished. The seal of the empire was given to Numan Cuproughly; who persuaded his master, that the law forbid him to invade the Czar, who had done him no injury; but to succour the king of Sweden as an unfortunate prince in his dominions. He sent his majesty 800 purses, every one of which amounted to 500 crowns, and advised him to return peaceably to his own dominions. Charles rejected this advice, threatening to hang up the bashaws, and shave the beards of any Janisaries who brought him such messages; and sent word that he should depend upon the Grand Signior's promise, and hoped to re-enter Poland as a conqueror with an army of Turks. After various intrigues at the Porte, an order was sent to attack this *head of iron*, as he was called, and to take him either alive or dead. He stood a siege in his house, with forty domestics, against the Turkish army; killed no less than 20 Janisaries with his own hand; and performed prodigies of valour on a very unnecessary and unwarrantable occasion. But the house being set on fire, and himself wounded, he was at last taken prisoner, and sent to Adrianople; where the Grand Signior gave him audience, and promised to make good all the damages he had sustained. At last, after a stay of about five years, he left Turkey; and, having disguised himself, traversed Wallachia, Transylvania, Hungary, and Germany, attended only by one person: and in 16 days riding, during which time he never went to bed, came to Stralsund at midnight, November 21, 1714. His boots were cut from his swollen legs, and he was put to bed; where, when he had slept some hours, the first thing he did was to review his troops, and examine the state of the fortifications. He sent out orders that very day, to renew the war with more vigour than ever. But affairs were now much changed: Augustus had recovered the throne of Poland; Sweden had lost many of its provinces, and was without money, trade, credit, or troops. The kings of Denmark and Prussia seized the island of Rugen; and besieged him in Stralsund, which surrendered; but Charles escaped to Carlscroon. When his country was threatened with invasion by so many princes, he, to the surprise of all Europe, marched into Norway with 20,000 men. A very few Danes might have stopped the Swedish army; but such a quick invasion they could not foresee. Europe was yet more at a loss to find the Czar so quiet, and not making a descent upon Sweden, as he had before agreed with his allies. This inaction was the consequence of one of the greatest designs, and at the same time the most difficult of any that were ever formed by the imagination of man. In short, a scheme was set on foot for a reconciliation with the Czar; for replacing Stanislaus on the throne of Poland; and setting James the second's son upon that of England, beside restoring the duke of Holstein to his dominions. Charles was pleased with these grand ideas, though without building much upon them, and gave his minister leave to act at large. In the mean time, Charles was going to make a second attempt upon Norway in 1718; and he flattered himself with being master of that kingdom in six months: but while he was examining the works at Fredericshall, a place of great strength and importance, which is reckoned to be the key of that kingdom, he was killed by a shot from the enemy, as has been generally believed; though it has been also reported that he fell by the treachery of one of his own officers, who had been bribed for that purpose. Charles.

This prince experienced the extremes of prosperity and of adversity, without being softened by the one, or disturbed for a moment at the other: but was a man rather extraordinary than great, and fitter to be admired than imitated. He was honoured by the Turks for his rigid abstinence from wine, and his regularity in attending public devotion.

As to his person, he was tall and of a noble mien, had a fine open forehead, large blue eyes, flaxen hair, fair complexion, an handsome nose, but little beard, and a laugh not agreeable. His manners were harsh and austere, not to say savage; and as to his religion, he was indifferent towards all, though exteriorly a Lutheran, and a strong believer in predestination. A few anecdotes will illustrate his character. No dangers, however great, made the least impression upon him. When a horse or two were killed under him at the battle of Narva in 1700, he leaped nimbly upon fresh ones, saying, "these people find me exercise." One day, when he was dictating letters to a secretary, a bomb fell through the roof into the next room of the house, where they were sitting. The secretary, terrified least the house should come down upon them, let his pen drop out of his hand; "What is the matter," says the king calmly. The secretary could only reply, "Ah, Sir, the bomb." "The bomb (says the king)! what has the bomb to do with what I am dictating to you? Go on."

He preserved more humanity than is usually found among conquerors. Once, in the middle of an action, finding a young Swedish officer wounded and unable to march, he obliged the officer to take his horse, and continued to command his infantry on foot. The princess Lubomirski, who was very much in the interest and good graces of Augustus, falling by accident into the hands of one of his officers, he ordered her to be set at liberty; saying, "that he did not make war with women." One day, near Leipsic, a peasant threw himself at his feet, with a complaint against a grenadier, that he had robbed him of certain eatables provided for himself and his family. "Is it true, (said Charles sternly), that you have robbed this man?" The soldier replied, "Sir, I have not done near so much harm to this man as your majesty has done to his master; for you have taken from Augustus a kingdom, whereas I have only taken from this poor scoundrel a dinner." Charles made the peasant amends, and pardoned the soldier for his firmness: "However, my friend (says he to him), you will do well to recollect, that if I took a kingdom from Augustus, I did not take it for myself."

Though Charles lived hardily himself, a soldier did not fear to remonstrate to him against some bread, which was very black and mouldy, and which yet was the only provision the troops had. Charles called for a piece of it, and calmly eat it up; saying, "that it was indeed not good, but that it might be eaten." From the danger he was in in Poland, when he beat the

the Saxon troops in 1702, a comedy was exhibited at Marienburg, where the combat was represented to the disadvantage of the Swedes. "Oh, (says Charles, hearing of it), I am far from envying them in this pleasure. Let them beat me upon the theatres as long as they will, provided I do but beat them in the field." He wrote some observations on war, and on his own campaigns from 1700 to 1709; but the MS. was lost at the unfortunate battle of Pultowa.

CHARLES's-CAPE, a promontory of Virginia, in North-America, forming the northern head-land of the strait that enters the bay of Cheasepeak.

*CHARLES's-Fort*, a fortress in the county of Cork, and province of Munster, in Ireland, situated at the mouth of Kinsale harbour. W. Long. 8. 20. and N. Lat. 51. 21.

*Morse's Geography.* CHARLESTON, the capital of the state of South-Carolina, is the only considerable town in that state. It is situated on the tongue of land which is formed by the the confluence of Ashley and Cooper rivers, which are large and navigable. These rivers mingle their waters immediately below the town, and form a spacious and convenient harbour, which communicates with the ocean at Sullivan's island, seven miles south-east of the town. In these rivers the tide rises, in common, about five feet. The continued agitation which this occasions in the waters which almost surround Charleston, and the refreshing sea breezes which are regularly felt, render Charleston more healthy than any part of the low country in the southern states. On this account it is the resort of great numbers of gentlemen, invalids from the West-India islands, and of the rich planters from the country, who come here to spend the *sickly months*, as they are called, in quest of health and of the social enjoyments which the city affords. And in no part of America are the social blessings enjoyed more rationally and liberally than in Charleston. Unaffected hospitality—affability—ease in manners and address—and a disposition to make their guests welcome, easy and pleased with themselves, are characteristics of the respectable people in Charleston.

The land on which the town is built is flat and low, and the water brackish and unwholesome. The inhabitants are obliged to raise banks of earth as barriers to defend themselves against the higher floods of the sea. The streets from east to west extend from river to river, and running in a straight line, not only open beautiful prospects each way, but afford excellent opportunities, by means of subterranean drains, for removing all nuisances and keeping the city clean and healthy. These streets are intersected by others, nearly at right angles, and throw the town into a number of squares, with dwelling houses in front, and office houses and little gardens behind. Some of the streets are conveniently wide, but most of them are much too narrow, especially for so populous a city, in so warm a climate. From their confined situation, they have been found extremely inconvenient in case of fires, the destructive effects of which have been frequently felt in this city. The houses, which have been lately built, are brick, with tiled roofs. Some of the buildings in Charleston are elegant, and most of them are neat, airy, and well furnished. The public buildings are an exchange, state-house, armoury, poor-house, two large churches for Episcopalians, two for Congregationalists or Independents, one for Scotch Presbyterians, two for the Baptists, one for the German Lutherans, one for the Methodists, one for French Protestants—besides a meeting house for Quakers, and two Jewish synagogues, one for the Portuguese, the other for the German Jews. There are upwards of a thousand Roman Catholics in Charleston, but they have no public building for worship.



In 1787, there were 1,600 houses in this city, and 9,600 white inhabitants, and 5,400 negroes: and what evinces the healthiness of the place, upwards of 200 of the white inhabitants were above sixty years of age.

Charleston was incorporated in 1783, and divided into 13 wards, who choose as many wardens, who, from among themselves, elect an intendant of the city. The intendant and wardens form the city council, who have power to make and enforce bye-laws for the regulation of the city. W. Long. 79. 0. and N. Lat. 32. 30.

*CHARLES's-Wain*, in astronomy, seven stars in the constellation called *ursa major*, or the Great Bear.

CHARLETON, an island at the bottom of Hudson's-bay, in North-America, subject to Great-Britain. W. Long. 80. 0. and N. Lat. 52. 30.

CHARLETON, (Walter) a learned English physician born in 1619, was physician in ordinary to Charles I. and Charles II. one of the first members of the royal society, and president of the college of physicians. He wrote on various subjects; but at last his narrow circumstances obliged him to retire to the island of Jersey, where he died in 1707.

CHARLOCK, the English name of the RAPHANUS; it is a very troublesome weed among corn, being more frequent than almost any other. There are two principal kinds of it; the one with a yellow flower, the other with a white. Some fields are particularly subject to be over-run with it, especially those which have been manured with cow-dung alone, that being a manure very favourable to the growth of it. The farmers in some places are so sensible of this, that they always mix horse-dung with their cow-dung, when they use it for arable land. When barley, as is often the case, is infested with this weed to such a degree as to endanger the crop, it is a very good method to mow down the charlock in May, when it is in flower, cutting it so low as just to take off the tops of the leaves of barley with it: by this means the barley will get up above the weed: and people have got four quarters of grain from an acre of such land as would have scarce yielded any thing without this expedient. Where any land is particularly subject to this weed, the best method is to sow it with grass seed, and make a pasture of it; for then the plant will not be troublesome, it never growing where there is a coat of grass upon the ground.

*Queen* CHARLOTTE's ISLAND, an island in the South Sea, first discovered by captain Wallis in the Dolphin, in 1767, who took possession of it in the name of King George III. Here is good water, and plenty of cocoa-nuts, palm-nuts, and scurvy-grass. The inhabitants are of a middle stature, and dark complexion, with long hair hanging over their shoulders;

the men are well made, and the women handſome; their cloathing is a kind of coarſe cloth, or matting, which they faſten about their middle.

*Queen* CHARLOTTE'*s Iſlands*, a cluſter of South-ſea iſlands diſcovered in 1767 by captain Carteret. He counted ſeven, and there were ſuppoſed to be many more. The inhabitants of theſe iſlands are deſcribed as extremely nimble and vigorous, and almoſt as well qualified to live in the water as upon land: they are very warlike; and, on a quarrel with ſome of captain Carteret's people, they attacked them with great reſolution; mortally wounded the maſter and three of the ſailors; were not at all intimidated by the fire-arms; and at laſt, notwithſtanding the averſion of captain Carteret to ſhed blood, he was obliged to ſecure the watering places by firing grape-ſhot into the woods, which deſtroyed many of the inhabitants. Theſe iſlands lie in S. Lat. 11°. E. Long. 164°. They are ſuppoſed to be the Santa Cruz of Mandana, who died there in 1595.

CHARM, a term derived from the Latin *carmen*, a "verſe;" and uſed to denote a magic power, or ſpell, by which, with the aſſiſtance of the devil, ſorcerers and witches, were ſuppoſed to do wonderful things, far ſurpaſſing the power of nature.

CHARNEL, or CHARNEL-HOUSE, a kind of portico or gallery, uſually in or near a church-yard, over which were anciently laid the bones of the dead, after the fleſh was wholly conſumed. Charnel-houſes are now uſually adjoining to the church.

CHARON, in fabulous hiſtory, the ſon of Erebus and Nox, whoſe office was to ferry the ſouls of the deceaſed over the waters of Acheron, for which each ſoul was to pay a piece of money. For this reaſon the Pagans had a cuſtom of putting a piece of money into the mouth of the dead, in order that they might have ſomething to pay Charon for their paſſage.

CHARONDAS, a celebrated legiſlator of the Thurians, and a native of Catanea in Sicily, flouriſhed 446 before Chriſt. He forbad any perſon's appearing armed in the public aſſemblies of the nation; but one day going thither in haſte, without thinking of his ſword, he was no ſooner made to obſerve his miſtake than he ran it through his body.

CHAROST, a town of France, in Berry, with the title of a duchy. It is ſeated on the river Arnon, E. Long. 2. 15. N. Lat. 46. 56.

CHAROUX, a town of France, in the Bourbonnois, ſeated on an eminence, near the river Sioulle. It has two pariſhes, which are in different dioceſes. E. Long. 3. 15. N. Lat. 46. 10.

CHARPENTIER, (Francis) dean of the French academy, was born in 1620. His early capacity inclined his friends to educate him for the bar: but he was much more delighted with the ſtudy of languages and antiquity than of the law; and preferred repoſe to tumult. M. Colbert made uſe of him in eſtabliſhing his new academy of medals and inſcriptions; and no perſon of that learned ſociety contributed more than himſelf towards that noble ſeries of medals which were ſtruck on the conſiderable events that diſtinguiſhed the reign of Louis XIV. He publiſhed ſeveral works, which were all well received; and died in 1702.



CHARR, in ichthyology. See SALMO.

CHARRON, (Peter) the author of a book intitled *Of Wiſdom*, which gained him great reputation, was born at Paris in the year 1541. After being advocate in the parliament of Paris for five or ſix years, he applied himſelf to divinity; and became ſo great a preacher, that the biſhops of ſeveral dioceſes offered him the higheſt dignities in their gift. He died at Paris, ſuddenly in the ſtreet, November 16, 1603.

CHART, or SEA-CHART, an hydrographical map, or a projection of ſome part of the earth's ſuperficies *in plano*, for the uſe of navigators.

Charts differ very conſiderably from geographical or land-maps, which are of no uſe in navigation. Nor are ſea-charts all of the ſame kind, ſome being what we call plane-charts others, mercator-charts, and others globular-charts.

*Plane*-CHART, is a repreſentation of ſome part of the ſuperficies of the terraqueous globe, in which the meridians are ſuppoſed parallel to each other, the parallels of latitude at equal diſtances, and conſequently the degrees of latitude and longitude every where equal to each other. See *PLANE-Chart*.

*Mercator's*-CHART, is that where the meridians are ſtraight lines, parallel to each other, and equidiſtant; the parallels are alſo ſtraight lines, and parallel to each other: but the diſtance between them increaſes from the equinoctial towards either pole, in the ratio of the ſecant of the latitude to the radius. See NAVIGATION.

*Globular*-CHART, a meridional projection, wherein the diſtance of the eye from the plane of the meridian, upon which the projection is made, is ſuppoſed to be equal to the ſine of the angle 45°. This projection comes the neareſt of all to the nature of the globe, becauſe the meridians therein are placed at equal diſtances; the parallels alſo are nearly equidiſtant, and conſequently the ſeveral parts of the earth have their proper proportion of magnitude, diſtance, and ſituation, nearly the ſame as on the globe itſelf. See *GLOBULAR Projection*.

*Hydrographic* CHARTS, ſheets of large paper, whereon ſeveral parts of the land and ſea are deſcribed, with their reſpective coaſts, harbours, ſounds, flats, rocks, ſhelves, ſands, &c. together with the longitude and latitude of each place, and the points of the compaſs. See *MERCATOR's-Chart*.

*Selenographic*-CHARTS, particular deſcriptions of the ſpots, appearances, and maculæ of the moon. See ASTRONOMY, n° 63. and 140.

*Topographic*-CHARTS, draughts of ſome ſmall parts of the earth only, or of ſome particular places, without regard to its relative ſituation, as London, York, &c.

CHARTA, or CARTA, primarily ſignifies a ſort of paper made of the plant *papyrus* or *biblus*. See PAPER and CHARTER.

*CHARTA-Emporetica*, in pharmacy, &c. a kind of paper made very ſoft and porous, uſed to filter withal. See FILTRATION, &c.

*CHARTA* is alſo uſed in ancient cuſtoms for a charter, or deed in writing. See CHARTER.

*Magna* CHARTA, the great charter of the liberties of Britain, and the baſis of their laws and privileges.



This

Charta.

This charter may be said to derive its origin from king Edward the Confessor, who granted several privileges to the church and state by charter: these liberties and privileges were also granted and confirmed by king Henry I. by a celebrated great charter now lost; but which was confirmed or re-enacted by king Henry II. and king John. Henry III. the successor of this last prince, after having caused 12 men make inquiry into the liberties of England in the reign of Henry I. granted a new charter; which was the same as the present magna charta. This he several times confirmed, and as often broke; till, in the 37th year of his reign, he went to Westminster-hall, and there, in presence of the nobility and bishops, who held lighted candles in their hands, magna charta was read, the king all the time holding his hand to his breast, and at last solemnly swearing faithfully and inviolably to observe all the things therein contained, &c. Then the bishops extinguishing the candles, and throwing them on the ground, they all cried out, "Thus let him be extinguished, and stink in hell, who violates this charter." It is observed, that, notwithstanding the solemnity of this confirmation, king Henry, the very next year, again invaded the rights of his people, till the barons entered into a war against him; when, after various success, he confirmed this charter, and the charter of the forest, in the 52d year of his reign.

This charter confirmed many liberties of the church, and redressed many grievances incident to feodal tenures, of no small moment at the time; tho' now, unless considered attentively and with this retrospect, they seem but of trifling concern. But, besides these feodal provisions, care was also taken therein to protect the subject against other oppressions, then frequently arising from unreasonable amercements, from illegal distresses, or other process for debts or services due to the crown, and from the tyrannical abuse of the prerogative of purveyance and pre-emption. It fixed the forfeiture of lands for felony in the same manner as it still remains; prohibited for the future the grants of exclusive fisheries; and the erection of new bridges so as to oppress the neighbourhood. With respect to private rights, it established the testamentary power of the subject over part of his personal estate, the rest being distributed among his wife and children; it laid down the law of dower, as it hath continued ever since; and prohibited the appeals of women, unless after the death of their husbands. In matters of public police and national concern, it enjoined an uniformity of weights and measures; gave new encouragements to commerce, by the protection of merchant-strangers; and forbad the alienation of lands in mortmain. With regard to the administration of justice: besides prohibiting all denials or delays of it, it fixed the court of common-pleas at Westminster, that the suitors might no longer be harrassed with following the king's person in all his progresses; and at the same time brought the trial of issues home to the very doors of the freeholders, by directing assizes to be taken in the proper counties, and establishing annual circuits: it also corrected some abuses then incident to the trials by wager of law and of battle; directed the regular awarding of inquests for life or member; prohibited the king's inferior ministers from holding pleas of the crown, or trying any criminal charge, whereby many forfeitures might otherwise have unjustly accrued to the exchequer; and regulated the time and place of holding the inferior tribunals of justice, the county-court, sheriff's torn, and court leet. It confirmed and established the liberties of the city of London, and all other cities, boroughs, towns, and ports of the kingdom. And lastly (which alone would have merited the title that it bears, of the *great charter*), it protected every individual of the nation in the free enjoyment of his life, his liberty, and his property, unless declared to be forfeited by the judgment of his peers, or the law of the land.

Charter, Charter-party.

This excellent charter, so equitable, and beneficial to the subject, is the most ancient written law in the kingdom. By the 25th Edward I. it is ordained, that it shall be taken as the common law; and by the 43d Edward III. all statutes made against it are declared to be void.

CHARTER, in law, a written instrument, or evidence of things acted between one person and another. The word charter comes from the Latin *charta*, anciently used for a public and authentic act, a donation, contract, or the like; from the Greek χαρτης, "thick paper" or "pasteboard," whereon public acts were wont to be written. Britton divides charters into those of the king, and those of private persons. 1. Charters of the king, are those whereby the king passeth any grant to any person or body politic, as a *charter of exemption* of privilege, &c.; *charter of pardon*, whereby a man is forgiven a felony, or other offence committed against the king's crown and dignity; *charter of the forest*, wherein the laws of the forest are comprised, such as the charter of Canutus, &c. 2. Charters of private persons, are deeds and instruments for the conveyance of lands, &c. And the purchaser of lands shall have all the charters, deeds, and evidences, as incident to the same, and for the maintenance of his title.

CHARTER-*Governments* in America. See COLONY.

CHARTER-*Land*, such land as a person holds by charter; that is, by evidence in writing, otherwise called freehold.

CHARTERPARTY, in commerce, denotes the instrument of freightage, or articles of agreement for the hire of a vessel. See FREIGHT, &c.

The charterparty is to be in writing; and to be signed both by the proprietor or the master of the ship, and the merchant who freights it. It is to contain the name and the burden of the vessel; the names of the master and the freighter; the price or rate of freight; and the time of loading and unloading; and the other conditions agreed on. It is properly a deed, or policy, whereby the master or proprietor of the vessel engages to furnish immediately a tight sound vessel, well equipped, caulked, and stopped, provided with anchors, sails, cordage, and all other furniture to make the voyage required, as equipage, hands, victuals, and other munitions; in consideration of a certain sum to be paid by the merchant for the freight. Lastly, the ship with all its furniture, and the cargo, are respectively subjected to the conditions of the *charterparty*. The *charterparty* differs from a *bill of lading*, in that the first is for the entire freight or lading, and that both

Chartophylax. | Charybdis.

both for going and returning; whereas the latter is only for a part of the freight, or at moſt only for the voyage one way.

The preſent Boyer ſays, the word comes from hence, that *per medium charta incidebatur, et ſic fiebat charta partita*; becauſe, in the time when notaries were leſs common, there was only one inſtrument made for both parties: this they cut in two, and gave each his proportion; joining them together at their return, to know if each had done his part. This he obſerves to have ſeen practiſed in his time; agreeable to the method of the Romans, who, in their ſtipulations, uſed to break a ſtaff, each party retaining a moiety thereof as a mark.

CHARTOPHYLAX, the name of an officer of the church of Conſtantinople, who attends at the door of the rails when the ſacrament is adminiſtered, and gives notice to the prieſts to come to the holy table. He repreſents the patriarch upon the bench, tries all eccleſiaſtical cauſes, keeps all the marriage regiſters, aſſiſts at the conſecration of biſhops, and preſents the biſhop elect at the ſolemnity, and likewiſe all other ſubordinate clergy. This office reſembles in ſome ſhape that of the *bibliothecarius* at Rome.

CHARTRES, a large city of France, in the province of Orleanois, ſituated on the river Eure, in E. Long. 1. 32. N. Lat. 48. 47. It is a biſhop's ſee.

CHARTREUSE, or CHARTREUSE-GRAND, a celebrated monaſtery, the capital of all the convents of the Carthuſian monks, ſituated on a ſteep rock in the middle of a large foreſt of fir-trees, about ſeven miles north-eaſt of Grenoble, in the province of Dauphine in France: E. Long. 5. 5. N. Lat. 45. 20. See CARTHUSIANS.

From this mother-convent, all the others of the ſame order take their name; among which was the Chartreuſe of London, corruptly called the charterhouſe, now converted into an hoſpital, and endowed with a revenue of 600l. *per ann.*

Here are maintained 80 decayed gentlemen, not under 50 years of age: alſo forty boys are educated and fitted either for the univerſity or trades. Thoſe ſent to the univerſity, have an exhibition of 20l. a year for eight years; and have an immediate title to nine church-livings in the gift of the governors of the hoſpital, who are ſixteen in number, all perſons of the firſt diſtinction, and take their turns in the nomination of penſioners and ſcholars.

CHARTULARY, CHARTULARIUS, a title given to an ancient officer in the Latin church, who had the care of charters and papers relating to public affairs. The chartulary preſided in eccleſiaſtical judgments, in lieu of the pope. In the Greek church the chartulary was called *chartophylax*; but his office was there much more conſiderable; and ſome even diſtinguiſh the chartulary from the chartophylax in the Greek church. See CHARTOPHYLAX.

CHARYBDIS, (anc. geog.) a whirlpool in the ſtraits of Meſſina, according to the poets; near Sicily, and oppoſite to Scylla, a rock on the coaſt of Italy. Thucydides makes it to be only a ſtrong flux and reflux in the ſtrait, or a violent reciprocation of the tide, eſpecially if the wind ſets ſouth. But on diving into the Charybdis, there are found vaſt gulphs and whirlpools below, which produce all the commotion on the ſurface of the water.

Chaſe.

*Charybdis* is uſed by Horace to denote a rapacious proſtitute.

CHASE, or CHACE, in law, is uſed for a driving of cattle to or from any place; as to a diſtreſs, or fortlet, *&c.*

CHASE, or *Chace*, is alſo a place of retreat for deer and wild beaſts; of a middle kind between a foreſt and a park, being uſually leſs than a foreſt, and not poſſeſſed of ſo many privileges; but wanting, *v. g.* courts of attachment, ſwainmote, and juſtice-ſeat.* Yet it is of a large extent, and ſtocked both with a greater diverſity of wild beaſts or game, and more keepers than a park. Crompton obſerves, that a foreſt cannot be in the hands of a ſubject, but it forthwith loſes its name, and becomes a *chaſe*; in regard all thoſe courts loſe their nature when they come into the hands of a ſubject; and that none but a king can make a lord chief juſtice in eyre of the foreſt. See JUSTICE *in Eyre*.

* See *Foreſt*.

"When our barons began to form a power, they claimed a vaſt, but more limited, tract for a diverſion that the Engliſh were always fond of. They were very jealous of any encroachments on their reſpective bounds, which were often the cauſe of deadly feuds: ſuch a one gave cauſe to the fatal day of *Chevy-chace*; a fact which, though recorded only in a ballad, may, from what we know of the manners of the times, be founded on truth: not that it was attended with all the circumſtances which the author of that natural but heroic compoſition hath given it; for, on that day, neither a *Percy* nor a *Douglas* fell: here the poet ſeems to have claimed his privilege, and mixed with this fray ſome of the events of the battle of *Otterbourne*." *Britiſh Zool.* i. 42.

CHASE, in the ſea-language, is to purſue a ſhip; which is alſo called *giving chaſe*.

*Stern* CHASE, is when the chaſer follows the chaſed aſtern directly upon the ſame point of the compaſs.

*To lie with a ſhip's fore-foot in a* CHASE, is to ſail and meet with her by the neareſt diſtance; and ſo to croſs her in her way, or to come acroſs her fore-foot.

A ſhip is ſaid to have a *good chaſe*, when ſhe is ſo built foreward on, or a-ſtern, that ſhe can carry many guns to ſhoot forwards or backwards; according to which ſhe is ſaid to have a *good foreward*, or *good ſtern chaſe*.

CHASE-*Guns*, are ſuch whoſe ports are either in the head (and then they are uſed in chaſing of others); or in the ſtern, which are only uſeful when they are purſued or chaſed by any other ſhip.

CHASE *of a Gun*, is the whole bore or length of a piece taken within-ſide.

*Wild-gooſe* CHACE, a term uſed to expreſs a ſort of racing on horſeback uſed formerly, which reſembled the flying of wild-geeſe; thoſe birds generally going in a train one after another, not in confuſed flocks as other birds do. In this ſort of race the two horſes, after running twelve ſcore yards, had liberty, which horſe ſoever could take the leading, to ride what ground the jockey pleaſed, the hindmoſt horſe being bound to follow him within a certain diſtance agreed on by the articles, or elſe to be whipped in by the tryers and judges who rode by; and whichever horſe could diſtance the other, won the race. This ſort of racing was not long in common uſe; for it was found inhuman, and destructive to good horses, when two such were matched together. For in this case neither was able to distance the other till they were both ready to sink under their riders; and often two very good horses were both spoiled, and the wagers forced to be drawn at last. The mischief of this sort of racing soon brought in the method now in use, of running only for a certain quantity of ground, and determining the plate or wager by the coming in first at the post.

*Chasing of Gold, Silver, &c.* See Enchasing.

CHASTE-tree. See Vitex.

CHASTITY; purity of the body, or freedom from obscenity.—The Roman law justifies homicide in defence of the chastity either of one's self or relations; and so also, according to Selden, stood the law in the Jewish republic. Our law likewise justifies a woman for killing a man who attempts to ravish her. So the husband or father may justify killing a man who attempts a rape upon his wife or daughter; but not if he takes them in adultery by consent: for the one is forcible and felonious, but not the other.

Chastity is a virtue universally celebrated. There is indeed no charm in the female sex that can supply its place. Without it, beauty is unlovely, and rank is contemptible; good breeding degenerates into wantonness, and wit into impudence. Out of the numerous instances of eminent chastity recorded by authors, the two following are selected on account of the lesson afforded by the different modes of conduct which they exhibit.

*Lucretia* was a lady of great beauty and noble extraction: she married Collatinus, a relation of Tarquinius Superbus, king of Rome. During the siege of Ardea, which lasted much longer than was expected, the young princes passed their time in entertainments and diversions. One day as they were at supper,* at Sextus Tarquin's the king's eldest son, with Collatinus, Lucretia's husband, the conversation turned to the merit of their wives: every one gave his own the preference. "What signify so many words?" says Collatinus; "you may in a few hours, if you please, be convinced by your own eyes, how much my Lucretia excels the rest. We are young: let us mount our horses, and go and surprise them. Nothing can better decide our dispute than the state we shall find them in at a time when most certainly they will not expect us." They were a little warmed with wine: "Come on, let us go," they all cried together. They quickly galloped to Rome, which was about twenty miles from Ardea, where they find the princesses, wives of the young Tarquins, surrounded with company, and every circumstance of the highest mirth and pleasure. From thence they rode to Collatia, where they saw Lucretia in a very different situation. With her maids about her, she was at work in the inner part of her house, talking on the dangers to which her husband was exposed. The victory was adjudged to her unanimously. She received her guests with all possible politeness and civility. Lucretia's virtue, which should have commanded respect, was the very thing which kindled in the breast of Sextus Tarquin a strong and detestable passion. Within a few days he returned to Collatia; and upon the plausible excuse he made for his visit, he was received with all the politeness due to a near relation, and the eldest son of a king. Watching the fittest opportunity, he declares the passion she had excited at his last visit, and employed the most tender entreaties, and all the artifices possible, to touch a woman's heart; but all to no purpose. He then endeavoured to extort her compliance by the most terrible threatenings. It was in vain. She still persisted in her resolution; nor could she be moved, even by the fear of death. But when the monster told her that he would first dispatch her, and then having murdered a slave, would lay him by her side, after which he would spread a report, that having caught them in the act of adultery, he had punished them as they deserved; this seemed to shake her resolution. She hesitated, not knowing which of these dreadful alternatives to take, whether, by consenting, to dishonour the bed of her husband, whom she tenderly loved; or, by refusing, to die under the odious character of having prostituted her person to the lust of a slave. He saw the struggle of her soul; and seized the unlucky moment, obtained an inglorious conquest. Thus Lucretia's virtue, which had been proof against the fear of death, could not hold out against the fear of infamy. The young prince, having gratified his passion, returned home as in triumph. On the morrow, Lucretia, overwhelmed with grief and despair, sent early in the morning to desire her father and her husband to come to her, and bring with them each a trusty friend, assuring them there was no time to lose. They came with all speed, the one accompanied with Valerius (so famous after under the name of Publicola), and the other with Brutus. The moment she saw them come, she could not command her tears; and when her husband asked her if all was well? "By no means," said she, "it cannot be well with a woman after she has lost her honour. Yes, Collatinus, thy bed has been defiled by a stranger: but my body only is polluted; my mind is innocent, as my death shall witness. Promise me only not to suffer the adulterer to go unpunished: it is Sextus Tarquinius, who last night, treacherous guest, or rather cruel foe, offered me violence, and reaped a joy fatal to me; but, if you are men, it will be still more fatal to him." All promised to revenge her; and, at the same time, tried to comfort her with representing, "That the mind only sins, not the body; and where the consent is wanting, there can be no guilt." "What Sextus deserves," replies Lucretia, "I leave you to judge; but for me, though I declare myself innocent of the crime, I exempt not myself from punishment. No immodest woman shall plead Lucretia's example to outlive her dishonour." Thus saying, she plunged into her breast a dagger she had concealed under her robe, and expired at their feet. Lucretia's tragical death has been praised and extolled by Pagan writers, as the highest and most noble act of heroism. The gospel thinks not so: it is murder, even according to Lucretia's own principles, since she punished with death an innocent person, at least acknowledged as such by herself. She was ignorant that our life is not in our own power, but in his disposal from whom we receive it. St Austin, who carefully examines, in his book *De Civitate Dei*, what we are to think of Lucretia's death, considers it not as a courageous action, flowing from a

* *Liv.* l. i. c. 56—60. *Dionys.* l. iv. p. 261—277. *Flor.* l. iii. 9.

Chastity, a true love of chastity, but as an infirmity of a woman too sensible of worldly fame and glory; and who, from a dread of appearing in the eyes of men an accomplice of the violence she abhorred, and of a crime to which she was entirely a stranger, commits a real crime upon herself voluntarily and designedly. But what cannot be sufficienly admired in this Roman lady is her abhorrence of adultery, which she seems to hold so detestable as not to bear the thoughts of it. In this sense, she is a noble example for all her sex.

*Chiomara*, the wife of Ortiagon, a Gaulish prince, was equally admirable for her beauty and chastity. During the war between the Romans and the Gauls, A. R. 563, the latter were totally defeated on Mount Olympus. Chiomara, among many other ladies, was taken prisoner, and committed to the care of a centurion, no less passionate for money than women. He, at first, endeavoured to gain her consent to his infamous desires; but not being able to prevail upon her, and subvert her constancy, he thought he might employ force with a woman whom misfortune had reduced to slavery. Afterwards, to make her amends for that treatment, he offered to restore her liberty; but not without ransom. He agreed with her for a certain sum, and to conceal this design from the other Romans, he permitted her to send any of the prisoners she should chose to her relations, and assigned a place near the river where the lady should be exchanged for gold. By accident there was one of her own slaves amongst the prisoners. Upon him she fixed; and the centurion soon after carried her beyond the advanced posts, under cover of a dark night. The next evening two of the relations of the princess came to the place appointed, whether the centurion also carried his captive. When they had delivered him the Attic talent they had brought, which was the sum they had agreed on, the lady, in her own language, ordered those who came to receive her to draw their swords and kill the centurion, who was then amusing himself with weighing the gold. Then, charmed with having revenged the injury done her chastity, she took the head of the officer, which she had cut off with her own hands, and hiding it under her robe, went to her husband Ortiagon, who had returned home after the defeat of his troops. As soon as she came into his presence, she threw the centurion's head at his feet. He was strangely surprised at such a sight; and asked her whose head it was, and what had induced her to do an act so uncommon to her sex? With a face covered with a sudden blush, and at the same time expressing her fierce indignation, she declared the outrage which had been done her, and the revenge she had taken for it. During the rest of her life, she stedfastly retained the same attachment for the purity of manners which constitutes the principal glory of the sex, and nobly sustained the honour of so glorious, bold, and heroic an action.—This lady was much more prudent than Lucretia, in revenging her injured honour by the death of her ravisher, rather than by her own. Plutarch relates this fact, in his treatise upon the virtue and great actions of women; and it is from him we have the name of this, which is well worthy of being transmitted to posterity.

The above virtue in men is termed *continence*. See CONTINENCE.

Chateau Briant || Chatelle-rault.

CHATEAU-BRIANT, a town of France in Brittany, with an old castle. W. Long. 1. 20. N. Lat. 47. 40.

*CHATEAU-Chinon*, a town of France in Nivernois, and capital of Morvant, with a considerable manufacture of cloth. E. Long. 3. 48. N. Lat. 47. 2.

*CHATEAU-Dauphin*, a very strong castle of Piedmont in Italy, and in the marquisate of Saluces, belonging to the king of Sardinia. It was taken by the combined army of France and Spain in 1744, and was restored by the treaty of Aix-la-Chapelle.

*CHATEAU-du-Loir*, a town of France in the Maine, famous for sustaining a siege of seven years against the Count of Mans. It is seated on the river Loir, in E. Long. 0. 25. N. Lat. 47. 40.

*CHATEAU-Dun*, an ancient town of France, and capital of the Dunois, with a castle and rich monastery; seated on an eminence near the river Loir, in E. Long 1. 26. N. Lat. 48. 4.

*CHATEAU-Neuf*, the name of several towns of France, *viz.* one in Perche; another in Angumois, on the river Charente, near Anguoseline; a third in Berry, seated on the river Cher; and several other small places.

*CHATEAU-Portien*, a town of France, in Champagne, and in a district called Portien, with a castle built on a rock, near the river Aine. E. Long. 4. 23. N. Lat. 49. 35.

*CHATEAU-Renaud*, a town of France, in the Gatenois, where clothes are made for the army, and where there is a trade in saffron. E. Long. 2. 25. N. Lat. 48. 0. This is also the name of a town of Touraine, in France, with the title of a marquisate. E. Long. 2. 41. N. Lat. 47. 22.

*CHATEAU-Roux*, a town of France, in Berry, with the title of a duchy. It has a cloth-manufacture, and is seated in a very large pleasant plain on the river Indre. in E. Long. 1. 47. N. Lat. 46. 49.

*CHATEAU-Thierra*, a town of France, in Champagne, with the title of a duchy, and a handsome castle on an eminence, seated on the river Maine, in E. Long. 3. 23. N. Lat. 49. 12.

*CHATEAU-Vilain*, a town of France, in Champagne, with a castle, and the title of a duchy; seated on the river Anjou. E. Long. 2. 59. N. Lat. 48. 0.

CHATEL, or CHATE, a town of Lorrain, in the Vosque, seated on the river Moselle, eight miles from Mirecourt.

*CHATEL-Aillon*, a maritime town of France, in Saintonge, five miles from Rochelle; formerly very considerable, but is now greatly decayed.

*CHATEL-Chalon*, a town of France, in Franche Compte, remarkable for its abbey of benedictine nuns. E. Long. 5. 25. N. Lat. 46. 50.

CHATELET, a town of the Netherlands, in Namur, seated on the Sambre, in the bishopric of Leige. E. Long. 4. 28. N. Lat. 50. 25.

CHATELET, the name of certain courts of justice established in several cities in France. The grand chatelet at Paris is the place where the presidial or ordinary court of justice of the provost of Paris is kept; consisting of a presidial, a civil chamber, a criminal chamber, and a chamber of policy. The little chatelet is an old fort, now serving as a prison.

CHATELLERAULT, a town of France, in Poi-



toa,

tou, with the title of a duchy; feated in a fertile and pleafant country, on the river Vienne, over which there is a handfome ftone-bridge. E. Long. 0. 40. N. Lat. 46. 34.

CHATHAM, a town of Kent, in England, adjoining to Rochefter, and feated on the river Medway. It is the principal ftation of the royal navy; and the yards and magazines are furnifhed with all kinds of naval ftores, as well as materials for building and rigging the largeft men of war. The entrance into the river Medway is defended by Sheernefs and other forts; notwithftanding which, the Dutch fleet burnt feveral fhips of war here in the reign of Charles II. after the peace of Breda had been agreed upon. In the year 1757, by direction of the Duke of Cumberland, feveral additional fortifications were begun at Chatham; fo that now the fhips are in no danger of an infult either by land or water. It has a church, a chapel of eafe, and a fhip ufed as a church for the failors. It has likewife about 500 houfes, moftly low, and built with brick; the ftreets are narrow, and paved; and it contains about 3000 inhabitants. The principal employment of the labouring hands is fhip-building in the king's yard and private docks. This town gave title of Earl to that great ftatefman William Pitt in the reigns of George II. and III. E. Long. 0. 40. N. Lat. 51. 20.

CHATIGAN, a town of Afia, in the kingdom of Bengal, on the moft eafterly branch of the river Ganges. It is but a poor place, though it was the firft the Portuguefe fettled at in thefe parts, and who ftill keep a fort of poffeffion. It has but a few cotton manufactures; but affords the beft timber for building of any place about it. The inhabitants are fo fufpicious of each other, that they always go armed with a fword, piftol, and blunderbufs, not excepting the priefts. It is fubject to the great Mogul. E. Long. 91. 10. N. Lat. 23. 0.

CHATILLON-SUR-SEINE, a town of France, in Burgundy, divided into two by the river Seine. It is 32 miles from Langres, and 40 from Dijon; and has iron works in its neigbourhood. E. Long. 4. 33. N. Lat. 47. 45.

CHATRE, a town of France, in Berry, feated on the river Indres, 37 miles from Bourges. It carries on a confiderable trade in cattle. E. Long. 1. 55. N. Lat. 46. 35.

CHATTELS, a Norman term, under which were anciently comprehended all moveable goods; thofe immoveable being termed *fief*, or *fee*.

CHATTELS, in the modern fenfe of the word, are all forts of goods, moveable or immoveable, except fuch as are in the nature of freehold.

CHATTERER, in ornithology. See AMPELIS.

CHATTERTON, (Thomas) a late unfortunate poet, whofe fate and performances have excited in no fmall degree the public attention, as well as given rife to much literary controverfy. He was born at Briftol, Nov. 20, 1752; and educated at a charity-fchool on St Auguftin's Back, where nothing more was taught than reading, writing, and accounts. At 14 years of age, he was articled clerk to an attorney at Briftol, with whom he continued about three years; yet, though his education was thus confined, he difcovered an early turn towards poetry and Englifh antiquities, and particularly towards heraldry. How foon he began to be an author is not known. In the Town and Country Magazine for March 1769, are two letters, probably from him, as they are dated from Briftol, and fubfcribed with his ufually fignature, D. B. that is, *Dunhelmus Briftolienfis*. The former contains fhort extracts from two MSS. "written 300 years ago by one Rowley a monk," concerning drefs in the age of Henry II.; the latter, "Ethelgar, a Saxon poem," in bombaft profe. In the fame magazine for May 1769, are three communications from Briftol, with the fame fignature D. B. one of them intitled "Obfervations upon Saxon Heraldry, with drawings of Saxon Atchievements;" and in the fubfequent months of 1769 and 1770, there are feveral other pieces in the fame magazine, which are undoubtedly of his compofition.

In April 1770, he left Briftol, difgufted with his profeffion, and irreconcileable to the line of life in which he was placed; and going to London in hopes of advancing his fortune by his pen, he funk at once from the fublimity of his views to an abfolute dependence on the patronage of bookfellers. Things, however, feem foon to have brightened up a little with him; for, May 14, he writes to his mother, in high fpirits, upon the change of his fituation, with the following farcaftic reflection upon his former patrons at Briftol. "As to Mr ——, Mr ——, Mr ——, &c. &c. they rate literary lumber fo low, that I believe an author, in their eftimation, muft be poor indeed, but here matters are otherwife. Had Rowley been a Londoner inftead of a Briftowyan, I could have lived by copying his works." In a letter to his fifter, May 30, he informs her that he is to be employed in writing a voluminous Hiftory of London, to appear in numbers the beginning of next winter. Meanwhile, he had written fomething in praife of Beckford, then lord mayor, which had procured him the honour of being prefented to his lordfhip; and, in the letter juft mentioned, he gives the following account of his reception, with certain obfervations upon political writing. "The lord mayor received me as politely as a citizen could: but the devil of the matter is, there is no money to be got on this fide of the queftion.—However, he is a poor author who cannot write on both fides.—Effays on the patriotic fide will fetch no more than what the copy is fold for. As the patriots themfelves are fearching for places, they have no gratuity to fpare.—On the other hand, unpopular effays will not even be accepted, and you muft pay to have them printed: but then you feldom lofe by it, as courtiers are fo fenfible of their deficiency in merit, that they generoufly reward all who know how to daub them with the appearance of it."

He continued to write inceffantly in various periodical publications. July 11th, he tells his fifter that he had pieces laft month in feveral magazines; in The Gofpel Magazine, The Town and country, The Court and City, The London, The Political Regifter, &c. But all thefe exertions of his genius brought in fo little profit, that he was foon reduced to the extremeft indigence; fo that at laft, oppreffed with poverty and alfo difeafe, in a fit of defpair he put an end to his exiftence, Aug. 1770, with a dofe of poifon. This unfortunate perfon, though certainly a moft extraordinary genius, feems yet to have been a moft ungracious compofition. He was violent and impetuous to a ftrange degree.

Chatterton degree. From the first of the above-cited letters, he seems to have had a portion of ill-humour and spleen more than enough for a lad of 17; and the editor of his Miscellanies records, "that he possessed all the vices and irregularities of youth, and that his profligacy was at least as conspicuous as his abilities."

In 1777 were published, in one volume 8vo, "Poems, supposed to have been written at Bristol, by Thomas Rowley and others, in the 15th century: the greatest part now first published from the most authentic copies, with an engraved specimen of one of the MSS. To which are added, a Preface, an introductory Account of the several Pieces, and a Glossary." And, in 1778, were published, in one volume 8vo, "Miscellanies in Prose and Verse, by Thomas Chatterton, the supposed author of the Poems published under the names of Rowley, &c."

Of Rowely's Poems, we have the following account in the preface, given in the words of Mr George Catcot of Bristol, to whom, it is said, the public is indebted for them. "The first discovery of certain MSS. having been deposited in Redclift church above three centuries ago, was made in the year 1768, at the time of opening the new bridge at Bristol; and was owing to a publication in Farley's Weekly Journal, Oct. 1st, containing an account of the ceremonies observed at the opening of the old bridge, taken, as it was said, from a very ancient MS. This excited the curiosity of some persons to enquire after the original. The printer, Mr Farley, could give no account of it, or of the person who brought the copy; but after much inquiry it was discovered, that this person was a youth between 15 and 16 years of age, whose name was Thomas Chatterton, and whose family had been sextons of Redclift church for near 150 years. His father, who was now dead, had also been master of the free-school in Pile-street. The young man was at first very unwilling to discover from whence he had the original: but, after many promises made to him, was at last prevailed on to acknowledge that he had received this, together with many other MSS. from his father, who had found them in a large chest in an upper room over the chapel, on the north side of Redclift church." It is added, that soon after this Mr Catcot commenced an acquaintance with Chatterton, and partly as presents, partly as purchases, procured from him copies of many of his MSS. in prose and verse; as other copies were disposed of in like manner to others. It is concluded, however, that whatever may have been Chatterton's part in this very extraordinary transaction, whether he was the author, or only (as he constantly asserted) the copier of all these productions, he appears to have kept the secret entirely himself, and not to have put it in any one's power to bear certain testimony either of his fraud or of his veracity.

This affair, however, hath since become the foundation of a mighty controversy among the critics, which hath yet scarcely subsided. The poems in question, published in 1777, were republished in 1778, with an "Appendix, containing some observations upon their language; tending to prove that they were written, not by any ancient author, but entirely by Chatterton." Mr Warton, in the third volume of his History of English poetry, hath espoused the same side of the question. Mr Walpole also obliged the world with a Letter on Chatterton, from his press at strawberry-hill. On the other hand have appeared, "Observations" upon these poems, "in which their authenticity is ascertained," by Jacob Bryant, Esq. 1781, 2 vols 8vo; and another edition of the "Poems, with a comment, in which their Antiquity is considered and defended, by Jeremiah Milles, D. D. Dean of Exeter, 1782," 4to. In answer to these two works, we have had three pamphlets: 1. "Cursory Observations on the Poems, and Remarks on the Commentaries of Mr Bryant and Dr Milles; with a salutary proposal addressed to the friends of those gentlemen." 2. "An Archæological Epistle to Dean Milles, editor of a superb edition of Rowley's Poems, &c." 3. "An Inquiry into the Authenticity of the Poems attributed to Thomas Rowley, in which the Arguments of the Dean of Exeter and Mr Bryant are examined, by Thomas Warton; and other pieces in the public prints and magazines: All preparatory to the complete settlement of the business in "A Vindication of the Appendix to the Poems called Rowley's, in reply to the Answers of the Dean of Exeter, by Jacob Bryant, Esq; and a third Anonymous Writer; with some further Observations upon those Poems, and an Examination of the Evidence which has been produced in support of their Authenticity. By Thomas Tyrwhitt, 1782," 8vo.

Chaucer CHAUCER, (Sir Geofrey) an eminent English poet in the 14th century, born at London in 1328. After he left the university, he travelled into Holland, France, and other countries. Upon his return he entered himself in the Inner-temple, where he studied the municipal laws of England. His first station at court was page to Edward III. and he had a pension granted him by that prince till he could otherwise provide for him. Soon after we find him gentleman of the king's privy chamber; next year, shield-bearer to the king. Esteemed and honoured, he spent his younger days in a constant attendance at court, or for the most part living near it, in a square stone-house near the park-gate at Woodstock, still called *Chaucer's House*.

Soon after, having got the Duke of Lancaster for his patron, Chaucer began every day to rise in greatness. In 1373, he was sent, with other persons, to the republic of Genoa to hire ships for the king's navy (their want of shipping in those times being usually supplied by such means); and the king was so well satisfied with his negociation, that, on his return, he obtained a grant of a pitcher of wine daily in the port of London, to be delivered by the butler of England; and soon after was made comptroller of the customs for wool, wool-fells, and hides; an office which he discharged with great diligence and integrity. At this period, Chaucer's income was about L. 1000 a-year; a sum which in those days might well enable him to live, as he says he did, with dignity in office, and hospitality among his friends. It was in this meridian blaze of prosperity, in perfect health of body and peace of mind, that he wrote his most humorous poems. His satires against the priests were probably written to oblige his patron the Duke of Lancaster, who favoured the cause of Wickliff, and endeavoured to expose the clergy to the indignation of the people. In the last year of Edward III. our poet was employed in a commission

mission to treat with the French; and in the beginning of King Richard's reign, he was in some degree of favour at court.

The Duke of Lancaster at last finding his views checked, began to abandon Wickliff's party: upon which Chaucer likewise, how much soever he had espoused that divine's opinions, thought it prudent to conceal them more than he had done. With the Duke's interest that of Chaucer entirely sunk; and the former passing over sea, his friends felt all the malice of the opposite party. These misfortunes occasioned his writing that excellent treatise *The Testament of Love*, in imitation of Boethius on the consolation of philosophy. Being much reduced he retired to Woodstock, to comfort himself with study, which produced his admirable treatise of the *Astrolabe*.

The Duke of Lancaster at last surmounting his troubles, married Lady Catherine Swynford, sister to Chaucer's wife; so that Thomas Chaucer, our poet's son, became allied to most of the nobility, and to several of the king's of England. Now the sun began to shine upon Chaucer with an evening ray; for by the influence of the Duke's marriage, he again grew to a considerable share of wealth. But being now 70, he retired to Dunnington-castle near Newbury. He had not enjoyed this retirement long before Henry IV. son of the Duke of Lancaster, assumed the crown, and in the first year of his reign gave our poet marks of his favour. But however pleasing the change of affairs might be to him at first, he afterwards found no small inconveniences from it. The measures and grants of the late king were annulled; and Chaucer, in order to procure fresh grants of his pensions, left his retirement, and applied to court, where, though he gained a confirmation of some grants, yet the fatigue of attendence, and his great age, prevented him from enjoying them. He fell sick at London; and ended his days in the 72d year of his age, leaving the world as though he despised it, as appears from his song of *Flie from the Prese*. The year before his death he had the happiness, if at his time of life it might be so called, to see the son of his brother-in-law (Hen. IV.) seated on the throne. He was interred in Westminster abbey; and in 1556, Mr Nicholas Bingham, a gentleman of Oxford, at his own charge, erected a handsome monument for him there. Caxton first printed the Canterbury Tales; but his works were first collected and published in one volume folio, by William Thynne, London, 1542. They were afterwards reprinted in 1561, 1598, 1602. Oxford, 1721.

Chaucer was not only the first, but one of the best poets which Britain ever produced. He was equally great in every species of poetry which he attempted; and his poems in general possess every kind of excellence, even to a modern reader, except melody and accuracy of measure; defects which are to be attributed to the imperfect state of the English language, and the infancy of the art in that kingdom at the time when he wrote. "As he is the father of English poetry (says Mr Dryden), so I hold him in the same degree of veneration as the Grecians held Homer, or the Romans Virgil. He is a perpetual fountain of good sense, learned in all sciences, and therefore speaks properly on all subjects. As he knew what to say, so he knows also when to leave off; a continence which is practised by few writers, and scarcely by any of the ancients, except Virgil and Horace." This character Chaucer certainly deserved. He had read a great deal; and was a man of the world, and of sound judgment. He was the first English poet who wrote *poetically*, as Dr Johnson observes in his preface to his Dictionary, and (he might have added) who wrote like a gentleman. He had also the merit of improving the language considerably, by the introduction and naturalization of words from the Provençal, at that time the most polished dialect in Europe.



CHAUCIS, (anc. geog.) the country of the Chauci, a people of Germany: divided into the *Minores*, now *East Frieseland* and the county of *Oldenburg*; and into the *Majores*, now the duchy of *Bremen* and a part of *Lunenburg*.

CHAUD-MEDLEY, in law, is of much the same import with *Chance-Medley*. The former in its etymology signifies an affray in the heat of blood or passion; the latter, a casual affray. The latter is in common speech too often erroneously applied to any manner of homicide by misadventure; whereas it appears by the stat. 24 Hen. VIII. c. 5. and ancient books (Staundf. P. C. 16.), that it is properly applied to such killing as happens in self-defence upon sudden encounter.

CHAL, a town of the East Indies, on the coast of Malabar, in the province of Blagana, and kingdom of Visapour. Its river affords a good harbour for small vessels. The town is fortified, and so is the island on the south side of the harbour. It had formerly a good trade, but is now miserably poor. It was taken by the Portuguese in 1507, to whom it still belongs. It is 15 miles south of Bombay, and five miles from the sea. E. Long. 72. 45. N. Lat. 18. 30.

CHAULIEU, (William Amfry de) abbé d'Amale, one of the most polite and ingenious of the French poets, was born in 1639, and died at the age of 84. The most complete edition of his poems is that printed in 2 vols 8vo in 1733.

CHAUMONT, a town of France, in Champagne, and in the district of Bassigni, of which it is the capital. It is seated on a mountain near the river Marne. E. Long. 5. 15. N. Lat. 48. 6.

CHAUNE, a town of France, in Picardy, and in the district of Sansterre, with the title of a duchy. E. Long. 2. 55. N. Lat. 49. 45.

CHAUNTRY See CHANTRY.

CHAUNY, a town of France, in Picardy, seated on the river Oise, in Chantry. E. Long. 3. 17. N. Lat. 49. 37.

CHAUVIN, (Stephen) a celebrated minister of the reformed religion, born at Nismes, left France at the revocation of the edict of Nantz, and retired to Rotterdam, where he began a new *Journal des Sçavans*; and afterwards removing to Berlin, continued it there three years. At this last place, he was made professor of philosophy, and discharged that office with much honour and reputation. His principal work is a philosophical dictionary, in Latin, which he published at Rotterdam in 1692; and gave a new edition of it much augmented, at Lewarden, in 1713, folio. He died in 1725, aged 85.

CHAVEZ, a strong town of Tralos-Montes in Portugal, is seated at the foot of a mountain on the river Tamega. It has two suburbs, and as many forts; one

one of which looks like a citadel. Between the town and ſuburb of Magdalena, is an old Roman ſtone-bridge about 92 geometrical paces long. W. Long. 7. 1. N. L. 41. 45.

CHAZELLES, (John Matthew) a celebrated French mathematician and engineer, was born at Lyons in 1657. M. du Hamel, with whom he got acquainted, finding his genius incline towards aſtronomy, preſented him to M. Caſſini, who employed him in his obſervatory. In 1684, the Duke of Mortemar made uſe of Chazelles to teach him mathematics; and, the year after, procured him the preferment of hydrography profeſſor for the galleys of Marſeilles, where he ſet up a ſchool for young pilots deſigned to ſerve aboard the galleys. In 1686, the galleys made four little campaigns, or rather four courſes, purely for exerciſe, Chazelles went on board every time with them; kept his ſchool upon the ſea, and ſhowed the practice of what he taught. In the year 1687 and 1688, he made two other ſea-campaigns, in which he drew a great many plans of ports, roads, towns, and forts, which were lodged with the miniſters of ſtate. At the beginning of the war, which ended with the peace of Ryſwick, ſome marine officers, and Chazelles among the reſt, fancied the galleys might be ſo contrived as to live upon the ocean; that they might ſerve to tow the men of war when the wind failed or proved contrary, and alſo help to ſecure the coaſt of France upon the ocean. Chazelles was ſent to the weſt coaſts in July 1689, to examine the practicableneſs of this ſcheme; and in 1690, fifteen galleys new built ſet ſail from Rochefort, and cruiſed as far as Torbay in England, and proved ſerviceable at the deſcent upon Tinmouth. After this, he digeſted into order the obſervations he had made on the coaſts of the ocean; and drew diſtinct maps with a portulan to them, *viz.* a large deſcription of every haven, of the depth, the tides, the dangers and advantages diſcovered, &c. Theſe maps were inſerted in the *Neptune Françoiſe*, publiſhed in 1692, in which year Chazelles was engineer at the deſcent at Oneille. In 1693, Monſieur de Pontchartrain, then ſecretary of ſtate for the marine, and afterwards chancellor of France, reſolved to get the *Neptune Françoiſe* carried on to a ſecond volume, which was alſo to take in the Mediterranean. Chazelles deſired that he might have a year's voyage on this ſea, for making aſtronomical obſervations; and the requeſt being granted, he paſſed by Greece, Egypt, and the other parts of Turkey, with his quadrant and teleſcope in his hand. When he was in Egypt he meaſured the pyramids; and finding the ſides of the largeſt preciſely facing the four cardinal points, naturally concluded this poſition to have been intended, and alſo that the poles of the earth and meridians had not ſince deviated. Chazelles likewiſe made a report of his voyage in the Levant, and gave the academy all the ſatisfaction they wanted concerning the poſition of Alexandria: upon which he was made a member of the academy in 1695. He died in 1710.

CHAZINZARIANS, a ſect of heretics who roſe in Armenia in the ſeventh century. The word is formed of the Armenian *chazus*, "croſs," They are alſo called *ſtaurolatræ*, which in Greek ſignifies the ſame as *Chazinzarians* in Armenian, *viz. adorers of the croſs*; they being charged with paying adoration to the croſs alone. In other reſpects they were Neſtorians; and admitted two perſons in Jeſus Chriſt. Nicephorus aſcribes other ſingularities to them; particularly their holding an annual feaſt in memory of the dog of their falſe prophet Sergius, which they called *artzibartzes*.



CHEASAPEAK BAY, in North America, the entrance between Cape Henry and Cape Charles, running up 300 miles between Virginia and Maryland. It is navigable almoſt all the way for large ſhips, and has ſeveral navigable rivers that fall into it, by means of which ſhips go up to the very doors of the planters, to take in their lading of goods.—Here was a ſea engagement in 1781 between the Britiſh fleet under Admiral Graves conſiſting of 19 ſhips of the line, and the French fleet of 24 line-of-battle ſhips under the Count de Graſſe, which ended in the Count's keeping poſſeſſion of the Bay, by which Lord Cornwallis and his whole army were made priſoners of war at York-town, being inveſted both by ſea and land by very ſuperior numbers.

CHEATS, are deceitful practices in defrauding, or endeavouring to defraud, another of his known right, by means of ſome artful device, contrary to the plain rules of common honeſty: as by playing with falſe dice, or by cauſing an illiterate perſon to execute a deed to his prejudice, by reading it over to him in words different from thoſe in which it was written, &c.—In England if any perſon deceitfully get into his hands or poſſeſſion any money or other things of any other perſon's by colour of any falſe token, &c. being convicted, he ſhall have ſuch puniſhment by impriſonment, ſetting upon the pillory, or by any corporeal pain except pains of death, as ſhall be adjudged by the perſons before whom he ſhall be convicted.—As there are frauds which may be relieved civilly, and not puniſhed criminally; ſo there are other frauds which in a ſpecial caſe may not be helped civilly, and yet ſhall be puniſhed criminally. Thus if a minor goes about the town, and, pretending to be of age, defrauds many perſons by taking credit for a conſiderable quantity of goods, and then inſiſting on his nonage, the perſons injured cannot recover the value of their goods, but they may indict and puniſh him for a common cheat. Perſons convicted of obtaining money or goods by falſe pretences, or of ſending threatening letters in order to extort money or goods, may be puniſhed with fine or impriſonment, or by pillory, whipping, or tranſportation.

CHEBRECHIN, a town of Poland, in the province of Ruſſia and Palatinate of Belſkow. It is ſeated on the declivity of a hill, and the river Wierpi waters its walls, and afterwards falls into the river Bog. The Jews there are very rich. E. Long. 23. 51. N. Lat. 50. 35.

CHECAYA, in Turkiſh affairs, the ſecond officer of the Janiſaries, who commands them under the aga, and is otherwiſe called *protogero*.

There is alſo a checaya of the treaſury, ſtables, kitchen, &c. the word ſignifying as much as lieutenant, or the ſecond in any office.

CHECK, or CHECK-*Roll*, a roll or book, wherein are contained the names of ſuch perſons as are attendants and in the pay of kings, or other great perſonages, as their houſhold ſervants.

*Clerk of the* CHECK *in the king's houſehold*, in Britain, has the check and controlment of the yeomen of the guard, and all the uſhers belonging to the royal family, allowing their abſence or defects in attendance, or diminiſhing their wages for the ſame, &c. He alſo, by himſelf or deputy, takes the view of thoſe that are to watch in the court, and has the ſetting of the watch, &c.

*Clerk of the* CHECK *in the royal dock-yards*, in Britain, an officer who keeps a muſter or regiſter of all the men employed aboard his majeſty's ſhips and veſſels, and alſo all the artificers and others in the ſervice of the navy at the port where he is ſettled.

CHECK, in falconry, a term uſed of a hawk, when ſhe forſakes her proper game, to fly at pyes, crows, rooks, or the like, that croſs her in her flight.

CHECKY, in heraldry, is when the ſhield, or a bordure, &c. is chequered, or divided in chequers or ſquares, in the manner of a cheſs-board.

This is one of the moſt noble and moſt ancient figures uſed in armoury; and a certain author faith, that it ought to be given to none but great warriors, in token of their bravery: for the cheſs-board repreſents a field of battle; and the pawns placed on both ſides repreſent the ſoldiers of the two armies, which move, attack, advance, or retire, according to the will of the gameſters, who are generals.

This figure is always compoſed of metal and colour. But ſome authors would have it reckoned among the ſeveral ſorts of furs.

CHEEK, in anatomy, that part of the face ſituated below the eyes on each ſide.

CHEEKS, a general name among mechanics, for almoſt all thoſe pieces of their machines and inſtruments, that are double, and perfectly alike. Thus, the cheeks of a printing-preſs are its two principal pieces: they are placed perpendicular, and parallel to each other; ſerving to ſuſtain the three ſommers, viz. the head, ſhelves, and winter, which bear the ſpindle, and other parts of the machine. See PRINTING-*Preſs*.

The *cheeks of a turner's lathe*, are two long pieces of wood, between which are placed the puppets, which are either pointed or otherwiſe, ſerving to ſupport the work and the mandrils of the workman. Theſe two pieces are placed parallel to the horizon, ſeparated from one another by the thickneſs of the tail of the puppets, and joined with tenons to two other pieces of wood placed perpendicularly, called the *legs of the lathe*.

*Cheeks of the glazier's vice*, are two pieces of iron joined parallel at top and bottom; in which are the axis, or ſpindles, little wheel, cuſhions, &c. whereof the machine is compoſed.

*The cheeks of a mortar*, or the *brackets*, in artillery, are made of ſtrong planks of wood, bound with thick plates of iron, and are fixed to the bed by four bolts; they riſe on each ſide of the mortar, and to ſerve to keep her at what elevation is given her, by the help of ſtrong bolts of iron which go through both cheeks, both under and behind the mortar, betwixt which are driven coins of wood; theſe bolts are called the *bracket bolts*, and the bolts which are put one in each end of the bed, are the traverſe-bolts, becauſe with handſpikes the mortar is by theſe traverſed to the right or left.

CHEEKS, in ſhip-building, are two pieces of timber, fitted on each ſide of the maſt at the top, ſerving to ſtrengthen the maſts there. The uppermoſt bail or piece of timber in the beak of a ſhip, is called the *cheek*. The knees which faſten the beak-head to the ſhip, are called *cheeks*; and the ſides of any block, or the ſides of a ſhip's carriage of a gun, are called *cheeks*.



CHEESE, a ſort of food prepared of curdled milk purged from the ſerum or whey, and afterwards dried for uſe.

Cheeſe differs in quality according as it is made from new or ſkimmed milk, from the curd which ſeparates ſpontaneouſly upon ſtanding, or that which is more ſpeedily produced by the addition of runnet. Cream alſo affords a kind of cheeſe, but quite fat and butyraceous, and which does not keep long. Analyzed chemically, cheeſe appears to partake much more of an animal nature than butter, or the milk from which it was made. It is inſoluble in every liquid except ſpirit of nitre, and cauſtic alkaline ley. Shaved thin, and properly treated with hot water, it forms a very ſtrong cement if mixed with quicklime.* When prepared with hot water, it is recommended in the Swediſh memoirs to be uſed by anglers as a bait: it may be made into any form, is not ſoftened by the cold water, and the fiſhes are fond of it. As a food, phyſicians condemn the too free uſe of cheeſe. When new, it is extremely difficult of digeſtion: when old, it becomes acrid and hot; and, from Dr Percival's experiments, is evidently of a ſceptic nature. It is a common opinion that old cheeſe digeſts every thing, yet is left undigeſted itſelf; but this is without any ſolid foundation. Cheeſe made from the milk of ſheep digeſts ſooner than that from the milk of cows, but is leſs nouriſhing; that from the milk of goats digeſts ſooner than either, but is alſo the leaſt nouriſhing. In general, it is a kind of food fit only for the laborious, or thoſe whoſe organs of digeſtion are ſtrong.

* See *Cement*.

Every country has places noted for this commodity: thus Cheſter and Glouceſter cheeſe are famous in England; and the Parmeſan cheeſe is in no leſs repute abroad, eſpecially in France. This ſort of cheeſe is entirely made of ſweet cow-milk: but at Rochefort in Languedoc, they make it of ewe's milk; and in other places it is uſual to add goat or ewe's milk in a certain proportion to that of the cow. There is likewiſe a kind of medicated cheeſe made by intimately mixing the expreſſed juice of certain herbs, as ſage, baum, mint, &c. with the curd before it is faſhioned into a cheeſe.—The Laplanders make a ſort of cheeſe of the milk of their rein-deer; which is not only of great ſervice to them as food, but on many other occaſions. It is a very common thing in theſe climates to have a limb numbed and frozen with the cold: their remedy for this is the heating an iron red hot, and thruſting it through the middle of one of theſe cheeſes; they catch what drops out, and with this anoint the limb, which ſoon recovers. They are ſubject alſo to coughs and diſeaſes of the lungs, and theſe they cure by the ſame ſort of medicine: they boil a large quantity of the cheeſe in the freſh deer's milk, and drink the decoction in large draughts warm ſeveral times a-day. They make a leſs ſtrong decoction of the ſame kind alſo, which they uſe as their common drink, for three or four days together, at ſeveral times of the year. They do

Cheeſe. do this to prevent the miſchiefs they are liable to from their water, which is otherwiſe their conſtant drink, and is not good.

The hundred weight of cheeſe pays on importation into Britain 1s. $3\frac{14}{20}$d. and draws back on exportation 1s. $1\frac{1}{2}$d. at the rate of 6s. 8d.

*Beſt methods of making cheeſe in England.* The double Glouceſter is a cheeſe that pleaſes almoſt every palate. The beſt of this kind is made from new, or (as it is called in that and the adjoining counties) *covered milk.* An inferior ſort is made from what is called *half-covered milk;* though when any of theſe cheeſes turn out to be good, people are deceived, and often purchaſe them for the beſt *covered milk cheeſe:* but farmers who are honeſt have them ſtamped with a piece of wood made in the ſhape of a heart, ſo that any perſon may know them.

It will be every farmer's intereſt (if he has a ſufficient number of cows) to make a large cheeſe from one meal's milk. This, when brought in warm, will be eaſily changed or turned with the rennet; but if the morning or night's milk be to be mixed with that which is freſh from the cow, it will be a longer time before it turns, nor will it change ſometimes without being heated over the fire, by which it often gets duſt or ſoot, or ſmoke, which will give the cheeſe a very diſagreeable flavour.

When the milk is turned, the whey ſhould be carefully ſtrained from the curd. The curd ſhould be broken ſmall with the hands; and when it is equally broken, it muſt be put by little at a time into the vat, carefully breaking it as it is put in. The vat ſhould be filled an inch or more above the brim, that when the whey is preſſed out it may not ſhrink below the brim; if it does, the cheeſe will be worth very little. But firſt, before the curd is put in, a cheeſe-cloth or ſtrainer ſhould be laid at the bottom of the vat; and this ſhould be ſo large, that when the vat is filled with the curd, the the ends of the cloth may turn again over the top of it. When this is done, it ſhould be taken to the preſs, and there remain for the ſpace of two hours; when it ſhould be turned and have a clean cloth put under it, and turned over as before. It muſt then be preſſed again, and remain in the preſs ſix or eight hours; when it ſhould again be turned and rubbed on each ſide with ſalt. After this it muſt be preſſed again for the ſpace of 12 or 14 hours more; when, if any of the edges project, they ſhould be pared off: it may then be put on a dry board, where it ſhould be regularly turned every day. It is a good way to have three or four holes bored round the lower part of the vat, that the whey may drain ſo perfectly from the cheeſe as not the leaſt particle of it may remain.

The prevailing opinion of the people of Glouceſterſhire and the neighbouring counties is, that the cheeſes will ſpoil if they do not ſcrape and waſh them when they are found to be mouldy. But others think that ſuffering the mould to remain, mellows them, provided they are turned every day. Thoſe, however, who will have the mould off, ſhould cauſe it to be removed with a clean dry flannel, as the waſhing the cheeſes is only a means of making the mould (which is a ſpecies of fungus rooted in the coat) grow again immediately.

Some people ſcald the curd: but this is a bad and mercenary practice; it robs the cheeſe of its fatneſs, and can only be done with a view to raiſe a greater quantity of whey butter, or to bring the cheeſes forward for ſale, by making them appear older than they really are.

As moſt people like to purchaſe high-coloured cheeſe, it may be right to mix a little annatto with the milk before it is turned. No cheeſe will look yellow without it; and though it does not in the leaſt add to the goodneſs, it is perfectly innocent in its nature and effects.

It is not in the power of any perſon to make good cheeſe with bad rennet; therefore the following receipt ſhould be attended to. Lethe *vell, maw, rennet-bag* (or by whatever name it is called), be perfectly ſweet; for if it be the leaſt tainted, the cheeſe will never be good. When this is fit for the purpoſe, three pints or two quarts of ſoft water (clean and ſweet) ſhould be mixed with ſalt, wherein ſhould be put ſweet-briar, roſe leaves and flowers, cinnamon, mace, cloves, and, in ſhort, almoſt every ſort of ſpice and aromatic that can be procured; and if theſe are put into two quarts of water, they muſt boil gently till the liquor is reduced to three pints, and care ſhould be taken that this liquor is not ſmoked. It ſhould be ſtrained clean from the ſpices, &c. and when found to be not warmer than milk from the cow, it ſhould be poured upon the vell or maw. A lemon may then be ſliced into it; when it may remain a day or two: After which it ſhould be ſtrained again, and put in a bottle; where, if well corked, it will keep good for twelve months or more. It will ſmell like a perfume; and a ſmall quantity of it will turn the milk, and give the cheeſe a pleaſing flavour. After this, if the vell be ſalted, and dried for a week or two near the fire, it will do for the purpoſe again almoſt as well as before.

Chedder cheeſe is held in high eſteem; but its goodneſs is ſaid to be chiefly owing to the land whereon the cows feed, as the method of making it is the ſame as is purſued throughout Somerſetſhire, and the adjoining counties.

Cheſhire cheeſe is much admired; yet no people take leſs pains with the rennet than the Cheſhire farmers. But their cheeſes are ſo large as often to exceed one hundred pounds weight each; to this (and the age they are kept, the richneſs of the land, and the keeping ſuch a number of cows as to make ſuch a cheeſe without adding a ſecond meal's milk) their excellence may be attributed. Indeed they ſalt the curd (which may make a difference), and keep the cheeſes in a damp place after they are made, and are very careful to turn them daily.

But of all the cheeſe England produces, none is more highly eſteemed than the Stilton, which is called the *Parmeſan* of England, and (except faulty) is never ſold for leſs than 1s. or 1s. 2d. per pound.

The Stilton Cheeſes are uſually made in ſquare vats, and weigh from ſix to twelve pounds each cheeſe. Immediately after they are made, it is neceſſary to put them into ſquare boxes made exactly to fit them; they being ſo extremely rich, that except this precaution be taken they are apt to bulge out and break aſunder. They ſhould be continually and daily turned in theſe boxes, and muſt be kept two years before they are properly mellowed for ſale.

Some make them in a net, ſomewhat like a cabbage net; ſo that they appear, when made, not unlike an a-

Cheese.

corn. But these are never so good as the other, having a thicker coat, and wanting all that rich flavour and mellowness which make them so pleasing.

It is proper to mention that the making of these cheeses is not confined to the Stilton farmers, as many others in Huntingdonshire (not forgetting Rutland and Northamptonshires) make a similar sort, sell them for the same price, and give all of them the name of *Stilton Cheeses*.

Though these farmers are remarked for cleanliness, they take very little pains with the rennet, as they in general only cut pieces from the vell or maw, which they put into the milk, and move gently about with the hand, by which means it breaks or turns so, that they easily obtain the curd. But if the method above described for making rennet were put in practice, they would make their cheese still better; at least they would not have so many faulty and unsound cheeses; for notwithstanding their cheeses bear such a name and price, they often find them so bad as not to be saleable; which is probably owing to their being so careless about the rennet.

It has been alleged, that as good cheese might be made in other counties, if people would adhere to the Stilton plan, which is this—They make a cheese every morning; and to this meal of new milk they add the cream taken from that which is milked the night before. This, and the age of their cheeses, have been supposed the only reasons why they are preferred to others; for from the nicest observation, it does not appear that their land is in any respect superior to that of other counties.

Excellent cream cheeses are made in Lincolnshire, by adding the cream of one meal's milk to milk which comes immediately from the cow; these are pressed gently two or three times, turned for a few days, and are then disposed of at the rate of 1s. per pound, to be eaten while new with radishes, sallad, &c.

Many people give skimmed milk to pigs, but the whey will do equally as well after cheeses are made from this milk; such cheeses will always sell for at least 2d. per pound, which will amount to a large sum annually where they make much butter. The peasants and many of the farmers in the north of England never eat any better cheese; and though they appear harder, experience hath proved them to be much easier of digestion than any new milk cheeses. A good market may always be found for the sale of them at Bristol.

*Account of the making of Parmesan Cheese:* by Mr Zappa of Milan, in answer to queries from Arthur Young, Esq.

"Are the cows regularly fed in stables?"—From the middle of April, or sooner if possible, the cows are sent to pasture in the meadows till the end of November usually.

"Or only fed in stables in winter?"—When the season is past, and snow comes, they are put into stables for the whole winter, and fed with hay.

"Do they remain in the pasture from morning till night? or only in hot weather?"—Between nine and ten in the morning the cows are sent to water, and then to the pastures, where they remain four or five hours at most, and at three or four o'clock are driven to the stables if the season is fresh, or under porticos if hot; where, for the night, a convenient quantity of hay is given them.

"In what months are they kept at pasture the whole day?"—Mostly answered already; but it might be said, that no owner will leave his cattle, without great cause, in uncovered places at night. It happens only to the shepherds from the Alps, when they pass, because it is impossible to find stables for all their cattle.

"What is the opinion in the Lodesan, on the best conduct for profit in the management of meadows?"—For a dairy farm of 100 cows, which yields daily a cheese weighing 70 to 75 lb. of 28 ounces, are wanted 1000 perticas of land. Of these about 800 are standing meadows, the other 200 are in the cultivation for corn and grass fields in rotation.

"Do you milk the cows morning and evening?"—Those that are in milk are milked morning and evening, with exception of such as are near calving.

"One hundred cows being wanted to make a Lodesan each day, it is supposed that it is made with the milk of the evening and the following morning; or of the morning and evening of the same day: how is it?"—The 100 cows form a dairy farm of a good large cheese; it is reckoned that 80 are in milk, and 20 with calves suckling, or near calving. They reckon one with the other about 32 boccalis of 32 oz. of milk. Such is the quantity for a cheese about 70 lb. of 28 ounces. They join the evening with the morning milk, because so it is fresher than if it was that of the morning and evening of the same day. The morning milk would be 24 hours old when the next morning the cheese should be made.

"Do they skim or not the milk to make butter before they make the cheese?"—From the evening milk all the cream possible is taken away for butter, mascarponi (cream-cheese), &c. The milk of the morning ought to be skimmed slightly; but every one skims as much cream as he can. The butter is sold on the spot immediately at 24 sous; the cheese at about 28 sous. The butter loses nothing in weight; the cheese loses one-third of it, is subject to heat, and requires expences of service, attention, warehouses, &c. before it is sold; and a man in two hours makes 45 to 50 lb. of butter that is sold directly. However, it is not possible to leave much cream in the milk to make Lodesan cheese, called *grained cheese*; because if it is too rich, it does not last long, and it is necessary to consume it while young and sound.

"Is Parmesan or Lodesan cheese made every day in the year or not?"—With 100 cows it is. In winter, however, the milk being less in quantity, the cheese is of lesser weight, but certainly more delicate.

"After gathering or uniting the milk, either skimmed or not, what is exactly the whole operation?"—The morning of the 3d of March 1786, I have seen the whole operation, having gone on purpose to the spot to see the whole work from beginning to end. At 16 Italian hours, or ten in the morning, according to the northern way to account hours, the skimming of that morning's milk, gathered only two hours before, was finished. I did, meanwhile, examine the boiler or pot. At the top it was eight feet (English) diameter, or thereabout; and about five feet three inches deep,

made

Cheese. made like a bell, and narrowing towards the bottom to about two one-half feet. They joined the cream produced that morning with the other produced by the milk of the evening before. That produced by this laſt milk was double in quantity to that of the morning milk, becauſe it had the whole night to unite, and that of the morning had only two hours to do it, in which it could not ſeparate much. Of the cream ſome was deſtined to make maſcarponies (cream-cheeſe), and they put the reſt into the machine for making butter. Out of the milk of the evening before and of that morning that was all put together after ſkimming, they took and put into the boiler 272 boccali, and they put under it two faggots of wood; which being burnt, were ſufficient to give the milk a warmth a little ſuperior to lukewarm. Then the boiler being withdrawn from the fire, the foreman put into it the rennet, which they prepare in ſmall balls of one ounce each, turning the ball in his hand always kept in the milk entirely covered; and after it was perfectly diſſolved, he covered the boiler to keep the milk defended, that it might not ſuffer from the coldneſs of the ſeaſon, in particular as it was a windy day. I went then to look on the man that was making maſcarponies, &c. and then we went twice to examine if the milk was ſufficiently coagulated. At the 18 hours, according to the Italian clocks, or noon, the true manufactory of cheeſe began. The milk was coagulated in a manner to be taken from the boiler in pieces from the ſurface. The foreman, with a ſtick that had 18 points, or rather nine ſmall pieces of wood fixed by their middle in the end of it, and forming nine points in each ſide, began to break exactly all the coagulated milk, and did continue to do ſo for more than half an hour, from time to time examining it to ſee its ſtate. He ordered to renew the fire, and four faggots of willow branches were uſed all at once: he turned the boiler that the fire might act; and then the underman began to work in the milk with a ſtick like the above, but with only four ſmaller ſticks at the top, forming eight points, four at each ſide, a ſpan long each point. In a quarter of an hour the foreman mixed in the boiler the proper quantity of ſaffron, and the milk was all in knobs, and finer grained than before, by the effect of turning and breaking the coagulation, or curd, continually. Every moment the fire was renewed or fed; but with a faggot only at a time, to continue it regular. The milk was never heated much, nor does it hinder to keep the hand in it to know the fineneſs of the grain, which refines continually by the ſtick-work of the underman. It is of the greateſt conſequence to mind when the grain begins to take a conſiſtence. When it comes to this ſtate, the boiler is turned from the fire, and the underman immediately takes out the whey, putting it into proper receivers. In that manner the grain ſubſides to the bottom of the boiler; and leaving only in it whey enough to keep the grain covered a little, the foreman extending himſelf as much as he can over and in the boiler, unites with his hands the grained milk, making like a body of paſte of it. Then a large piece of linen is run by him under that paſte, while another man keeps the four corners of it, and the whey is directly put again into the boiler, by which is facilitated the means of raiſing that paſte that is taken out of the boiler, and put for one quarter of an hour into the receiver where the whey was put before, in the ſame linen it was taken from the boiler; which boiler is turned again directly on the fire, to extract the maſcarpa (whey-cheeſe); and is a ſecond product, eaten by poor people. After the paſte remained for a quarter of an hour in that receiver, it was taken out and turned into the wooden form called *faſſera*, without any thing elſe made than the rotundity, having neither top or bottom. Immediately after having turned it into that round wooden form, they put a piece of wood like a cheeſe on it, putting and increaſing gradually weights on it, which ſerve to force out the remnant of whey; and in the evening the cheeſe ſo formed is carried into the warehouſe, where, after 24 hours, they begin to give the ſalt. It remains in that warehouſe for 15 or 20 days; but in ſummer only from 8 to 12 days. Meanwhile the air and ſalt form the cruſt to it; and then it is carried into another warehouſe for a different ſervice. In the ſecond warehouſe they turn every day all the cheeſes that are not older than ſix months; and afterwards it is enough if they are only turned every 48 or 60 hours, keeping them clean, in particular of that bloom which is inevitable to them, and which, if neglected, turns muſty, and cauſes the cheeſe to acquire a bad ſmell. The Lodeſan, becauſe it is a province watered, has a great deal of meadows, and abounds with cows, its product being moſtly in cheeſe, butter, &c. However, the province of Pavia makes a great deal of that cheeſe; and we Milaneſe do likewiſe the ſame from the ſide of Porte Toſa, Romana, Ticineſe, and Vercillina, becauſe we have fine meadows and dairy farms.

Cheese || Cheiranthus.

*Cheese-Rennet.* See Gallium and Runnet.

CHEGOE, or Nigua, the Indian name of an inſect common in Mexico, and alſo found in other hot countries where it is called *pique*, is an exceeding ſmall animal, not very unlike a flea, and is bred in the duſt. It fixes upon the feet, and breaking inſenſibly the cuticle, it neſtles betwixt that and the true ſkin, which alſo, unleſs it is immediately taken out, it breaks, and pierces at laſt to the fleſh, multiplying with a rapidity almoſt incredible. It is ſeldom diſcovered until it pierces the true ſkin, when it cauſes an intolerable itching. Theſe inſects, with their aſtoniſhing multiplication, would ſoon diſpeople thoſe countries, were it leſs eaſy to avoid them, or were the inhabitants leſs dexterous in getting them out before they begin to ſpread. On the other hand, nature, in order to leſſen the evil, has not only denied them wings, but even that conformation of the legs and thoſe ſtrong muſcles which are given to the flea for leaping. The poor, however, who are in ſome meaſure doomed to live in the duſt, and to a habitual neglect of their perſons, ſuffer theſe inſects ſometimes to multiply ſo far as to make large holes in their fleſh, and even to occaſion dangerous wounds.

CHEIRANTHUS, stock-gilliflower, or *Wall-flower*: A genus of the 39th natural order, *Siliquoſæ*; and belonging to the tetradynamia claſs of plants. The germen is marked with a glandulous denticle on each ſide; the calyx is cloſe, with two of its leaves gibbous at the baſe; the ſeeds plane. The ſpecies are 13; but the following three are moſt worthy of notice. 1. The cheiri, or common wall-flower, with ligneous, long, tough roots; an upright, woody, abiding ſtalk, divided into many erect angular branches, forming a buſhy head from one to two feet high, cloſely garniſhed with

Cheiranthus | Cheke.

spear-shaped, acute, smooth leaves, and all the branches terminating in long erect spikes of numerous flowers, which in different varieties are yellow, bloody, white, &c. 2. The incanus, or hoary cheiranthus, with ligneous, long, naked, white roots; and upright, strong, woody, abiding stem, from one to three feet high, branchy at top, adorned with long, spear-shaped, obtuse, hoary leaves; and the top of the stalk and all the branches terminated by erect spikes of flowers from one to two or three feet long, of different colours in different varieties. 3. The annuus, or ten-weeks-stock, with an upright, woody, smooth stalk, divided into a branchy head, 12 or 15 inches high, garnished with spear-shaped, blunt, hoary leaves, a little indented, and all the branches terminated by long erect spikes of numerous flowers of different colours in different varieties.—The two first sorts are very hardy evergreen biennials or perennials; but the last is an annual plant, so must be continued by seed sown every year; and even the two first, notwithstanding their being perennial, degenerate so much in their flowers after the first year, that it will be proper also to raise an annual supply of them. The seeds are to be saved only from the plants with single flowers; for the double ones bring no seeds to perfection. The seeds are to be chosen from such flowers as have five, six, or more petals, or from such as grow near to the double ones. They may be sown in the full ground in the spring, and may be afterwards transplanted. When fine doubles of the two first kinds are obtained, they may be multiplied by slips from the old plants.

CHEKAO, in natural history, the name of an earth found in many parts of the East Indies, and sometimes used by the Chinese in their porcelain manufactures. It is a hard and stony earth; and the manner of using it is this: they first calcine it in an open furnace, and then beat it to a fine powder. This powder they mix with large quantities of water: then stirring the whole together, they let the coarser part subside; and pouring off the rest yet thick as cream, they leave it to settle, and use the matter which is found at the bottom in form of a soft paste, and will retain that humidity a long time. This supplies the place of the earth called *hoache*, in the making of that elegant sort of china-ware which is all white, and has flowers which seem formed by a mere vapour within its surface. The manner of their using it is this: they first make the vessel of the common matter of the manufacture; when this is almost dry, they paint upon it the flowers, or whatever other figures they please, with a pencil dipt in this preparation of the chekao; when this is thoroughly dry, they cover the whole vessel with the varnish in the common way, and bake it as usual. The consequence is, that the whole is white: but the body of the vessel, the figures, and the varnish, being three different substances, each has its own particular white; and the flowers being painted in the finest white of all, are distinctly seen through the varnish upon the vessel, and seem as if traced by a vapour only. The hoache does this as well as the chekao; and has besides this the quality of serving for making the porcelain ware either alone, or in the place of kaolin: the chekao has not this property, nor any other substance besides this hoache, which appears to be the same with the steaties or soap-rock.

CHEKE, (Sir John) a celebrated statesman, grammarian, and divine, of an ancient family in the isle of Wight, was born at Cambridge in the year 1514, and educated at St John's college in that university; where, after taking his degrees in arts, he was first chosen Greek lecturer, and in 1540 professor of that language, with a stipend of 40l. a-year. In this station he was principally instrumental in reforming the pronunciation of the Greek language, which, having been much neglected, was imperfectly understood. About the year 1543 he was incorporated master of arts at Oxford, where, we are told, he had studied for some time. In the following year he was sent to the court of king Henry VIII. and appointed tutor for the Latin language, jointly with Sir Anthony Cooke, to prince Edward, about which time he was made canon of the college newly founded in Oxford; wherefore he must have now been in orders. On the accession of his royal pupil to the crown, Mr Cheke was first rewarded with a pension of 100 merks, and afterwards obtained several considerable grants from the crown. In 1550 he was made chief gentleman of the privy-chamber, and was knighted the following year; in 1552, chamberlain of the exchequer for life; in 1553, clerk of the council; and soon after secretary of state and privy-councillor. But these honours were of short duration. Having concurred in the measures of the duke of Northumberland for settling the crown on the unfortunate Jane Grey, and acted as her secretary during the nine days of her reign, on the accession of queen Mary, Sir John Cheke was sent to the tower, and stript of the greatest part of his possessions. In September 1554 he obtained his liberty, and a licence from her majesty to travel abroad. He went first to Basil, thence to Italy, and afterwards returned to Strasburg, where he was reduced to the necessity of reading Greek lectures for subsistence. In 1556 he set out in an evil hour to meet his wife at Brussels: but, before he reached that city, he was seized by order of king Philip II. hoodwinked, and thrown into a waggon; and thus ignominiously conducted to a ship, which brought him to the tower of London. He soon found that religion was the cause of his imprisonment; for he was immediately visited by two Romish priests, who piously endeavoured to convert him, but without success. However, he was at last visited by Fleckenham; who told him from the queen, that he must either comply or burn. This powerful argument had the desired effect; and Sir John Cheke accordingly complied in form, and his lands, upon certain conditions, were restored: but his remorse soon put an end to his life. He died in September 1557, at the house of his friend Mr Peter Osborne in Wood-street, London, and was buried in St Alban's church. He left three sons, the eldest of whom, Henry, was knighted by queen Elizabeth. He wrote 1. A Latin translation of two of St Chrysostom's homilies. Lond. 1543, 4to. 2. The Hurt of Sedition. Lond. 1549, 1576, 1641. 3. Latin Translation of the English Communion Service. Printed among Bucer's opuscula. 4. De pronunciatione Græcæ. Basil, 1555, 8vo. 5. Several letters published in his life by Strype; and a great number of other books.

Cheke. | Che-kyang.

CHE-KYANG, or TCHE-KIANG, a maritime province of China, and one of the most considerable in the empire; is bounded on the south by Fo-kien; on the north and west by Kiang-nan and Kiangsi; and on the east by the sea. The air is pure and healthful, and the soil fertile, being watered by a number of rivers and canals, as well as springs and lakes. The chief produce is silk; a vast quantity of which is cultivated here, and for which the whole country is covered with mulberry trees. These are purposely checked in their growth by the natives, experience having taught them, that the leaves of the smallest trees produce the best silk. The stuffs made in this province, which are embroidered with gold and silver, are reckoned the best in the empire: and notwithstanding a vast exportation to the Japan and Philippine islands, as well as to every part of China, and to Europe, such an abundance is left in the province, that a complete suit of silk may be bought here as cheap as one of the coarsest woollen in France.

This province is also remarkable for a particular species of mushrooms, which is exported to every part of the empire. They are pickled, and then dried; when they will keep good for a whole year. When used they must be soaked in water, which renders them as fresh as at first. Here also the tallow tree is met with; and the province affords excellent hams, and those small gold-fishes with which the ponds are usually stocked.

Che-kyang contains 11 cities of the first class, 72 of the third, and 18 fortresses, which, in Europe, would be accounted large cities. The principal of these are, 1. Hang-tcheou-fou, the metropolis, accounted by the Chinese to be the paradise of the earth. It is four leagues in circumference, exclusive of the suburbs; and the number of its inhabitants are computed at more than a million, and 10,000 workmen are supposed to be employed within its walls in manufacturing of silk. Its principal beauty is a small lake, close to the walls on the western side, the water of which is pure and limpid, and the banks almost every where covered with flowers. Its banks are likewise adorned with halls and open galleries supported by pillars, and paved with large flag-stones for the convenience of those who are fond of walking; and the lake itself is intersected with causeways cased with cut-stone, openings covered with bridges being left in them for the passage of boats. In the middle are two islands with a temple and several pleasure-houses, and the emperor has a small palace in the neighbourhood. The city is garrisoned by 3000 Chinese and as many Tartars, and has under its jurisdiction seven cities of the third class. 2. Hou-tcheou-fou is also situated on a lake, and manufactures an incredible quantity of silk, insomuch, that the tribute of a city under its jurisdiction amounts to more than 500,000 ounces of silver. 3. Ning-po-fou, by Europeans called Liampo, is an excellent port, opposite to Japan. Eighteen or twenty leagues from it is an island called Tcheou-chan, where the English first landed on their arrival at China. 4. Ning-po is remarkable for the silk manufactured there, which is much esteemed in foreign countries, especially Japan, where it is exchanged for gold, silver, and copper. 5. Chao-hing-fou, situated in an extensive and fertile plain, is remarkable for a tomb about half a league distant, which is said to be that of *Yu*. The people of this province are said to be the most versed in chicanery of any in China. 6. Tchu-tcheou-fou, remarkable for having in its neighbourhood pines of an extraordinary size, capable of containing 40 men in their trunks. The inhabitants are ingenious, polite, and courteous to strangers, but very superstitious.



CHELIDONIAS, according to Pliny, an anniversary wind, blowing at the appearance of the swallows; otherwise the Favonius, or Zephyrus.

CHELIDONIUM, Celandine, and Horned or prickly poppy: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 27th order, *Rhœadeæ*. The corolla is tetrapetalous, the calyx diphyllous, the siliqua unilocular and linear. There are six species, none of which are remarkable for their beauty; but one of them, *viz.* the majus, is an article in the materia medica. It grows on old walls, among rubbish, and in waste shady places. The herb is of a bluish green colour; the root of a deep red; and both contain a gold-coloured juice: their smell is disagreeable, the taste somewhat bitterish, very acrid, burning and biting the mouth; the root is the most acrid. The juice takes off warts; cures tetters, ring-worms, and the itch; and, diluted with milk, it consumes opaque white spots on the eye.—Horses, cows, goats, and swine, refuse to eat the herb.

CHELIDONIUS lapis, in natural history, a stone said by the ancients to be found in the stomachs of young swallows, and greatly cried up for its virtues in the falling-sickness; but, from their description, it appears to be only a species of lycodontes, or bufonitæ. See Lycodontes, and Bufonitæ.

CHELM, a town of Poland, capital of a palatinate of the same name. It is situated in the province of Red Russia. E. Long. 23. 30. N. Lat. 51. 25.

CHELMSFORD, the county town of Essex, situated on the river Chelmer, in E. Long. 0. 30. N. Lat. 51. 40. It sends two members to parliament.

CHELONE, in botany: 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 quinquepartite; the rudiment of a fifth filament among the highest stamina, the capsule bilocular. There are three species, *viz.* the Glabra, the Hirsuta, and the Penstemon. They are natives of North America; and are herbaceous flowery perennials, with upright stalks two feet high, decorated with spear-shaped leaves, and beautiful spikes of monopetalous, ringent flowers, red, rose-coloured, blue, and purple. They flower from September to November, and are sometimes succeeded by ripe seeds in Britain. They are very hardy plants, and may be propagated by seeds sown in any soil or situation; but the two first multiply so fast by their creeping roots, that the seeds are seldom regarded.

CHELSEA, a fine village situated on the northern bank of the river Thames, a mile westward of Westminster, remarkable for a magnificent hospital of invalids and old decrepit soldiers; and a pleasure-house, called Ranelagh, to which a great deal of fine company resort in summer; and a noble botanic garden belonging to the company of apothecaries. The royal hospital of invalids was begun by Charles II. carried on by James II. and finished by king William. It consists of a vast range of buildings, that form three large squares, in which there is an uncommon air of neatness and elegance observed. It is under the direction of commissioners, who consist generally of the officers of ſtate and of war. There is a governor with 500 l. ſalary, a lieutenant governor with 400 l. and a major, with 250 l. beſides inferior officers, ſerjeants, corporals and drums, with about 400 men, who all do garriſon duty; and there are above 10,000 out penſioners who receive an annuity of 7l. 12s. 6d. each; all which expence is defrayed by a poundage deducted from the army, deficiences being made good by parliament.—The botanic garden is very extenſive, enriched with a vaſt variety of domeſtic and exotic plants, the original ſtock of which was given to the apothecaries of London by Sir Hans Sloane.—At Ranelagh Garden and amphitheatre the entertainment is a fine band of muſic, with an organ and ſome of the beſt voices, and the regale is tea and coffee.


CHELTENHAM, or CHILTENHAM, a market town of Glouceſterſhire, ſeven miles north-eaſt of Glouceſter. W. Long. 2. 10. N. Lat. 51. 50. It is chiefly remarkable for its mineral waters, of the ſame kind with thoſe of Scarborough. See SCARBOROUGH.

CHEMISE, in fortification, the wall with which a baſtion, or any other bulwark of earth, is lined for its greater ſupport and ſtrength: or it is the ſolidity of the wall from the talus to the ſtone-row.

*Fire-CHEMISE*, a piece of linen cloth, ſteeped in a compoſition of oil of petrol, camphor, and other combuſtible matters, uſed at ſea, to ſet fire to an enemy's veſſel.

# CHEMISTRY

1 Definition. MAY be defined, The ſtudy of ſuch phenomena or properties of bodies as are diſcovered by variouſly mixing them together, and by expoſing them to different degrees of heat, alone, or in mixture, with a view to the enlargement of our knowledge in nature, and to the improvement of the uſeful arts: or, It is the ſtudy of the effects of heat and mixture upon all bodies, whether natural or artificial, with a view to the improvement of arts and natural knowledge.

2 Antiquity. The ſcience of chemiſtry is undoubtedly of very high antiquity; and, like moſt other ſciences, its origin cannot be traced. In ſcripture, Tubal Cain, the 8th from Adam, is mentioned as the father or inſtructor of every artificer in braſs or iron. This, however, does not conſtitute him a chemiſt, any more than a founder or blackſmith among us has a right to that title. The name of chemiſt could only belong to him, whoever he was, who firſt diſcovered the method of extracting metals from their ores; and this perſon muſt neceſſarily have lived before Tubal Cain, as every blackſmith or founder muſt have metals ready prepared to his hand. Neverthele ſs, as Tubal Cain lived before the flood, and the ſcience of chemiſtry muſt have exiſted before his time, ſome have conjectured, that the metallurgic part, on account of its extreme uſefulneſs to mankind, was revealed to Adam by God himſelf.

3 Science founded. Be this as it will, *Siphoas*, an Egyptian, is conſidered by the chemiſts as the founder of their ſcience. He was known by the Greeks under the name of *Hermes*, or *Mercurius Triſmegiſtus*; and is ſuppoſed to have lived more than 1900 years before the Chriſtian æra. A numerous liſt of this philoſopher's works is given by Clemens Alexandrinus; but none of them are now to be found, nor do any of them appear to have been written profeſſedly on chemiſtry.

Two illuſtrious Egyptians, of the name of Hermes, are recorded by ancient authors. The elder ſuppoſed to be the ſame with *Mizraim*, the grandſon of Noah, the *Hermes* of the Greeks, and *Mercury* of the Romans. The younger Hermes lived a thouſand years afterwards; and is ſuppoſed to have reſtored the ſciences after they had fallen into oblivion, in conſequence of an inundation of the Nile. No leſs than 36,000 books are ſaid to have been written under the name of Hermes; but, according to Jamblichus, a cuſtom prevailed of inſcribing all books of ſcience with the name of Hermes. Some authors deny the exiſtence of Hermes, and maintain that his hiſtory is allegorical.

4 Moſes ſuppoſed to be ſkilled in chemiſtry. As the ſcience of chemiſtry is ſuppoſed to have been well known to the Egyptians, Moſes, who was ſkilled in their wiſdom, is thence ranked among the number of chemiſts; a proof of whoſe ſkill in this ſcience is thought to be, his diſſolving the golden calf made by the Iſraelites, ſo as to render it potable.

Of all the Greeks who travelled into Egypt in order to acquire knowledge, Democritus alone was admitted into their myſteries. The Egyptian prieſts are ſaid to have taught him many chemical operations; among which were the art of ſoftening ivory, of vitrifying flints, and of imitating precious ſtones. Dr Black, however, is of opinion, that Democritus knew nothing more of theſe arts than that of making a coarſe kind of glaſs, as no mention is particularly made of his imitating any other precious ſtone than the emerald, whoſe colour is green; and the coarſer the glaſs the greener it is.

After the time of Democritus, we may know that conſiderable improvements were made in chemiſtry, as phyſicians began to make uſe of metallic preparations, as ceruſe, verdegris, litharge, &c. Dioſcorides deſcribes the diſtillation of mercury from cinnabar by means of an *embic*, from which, by adding the Arabic *Al*, comes the term *Alembic*. The art of diſtillation, however, at that time was in a very rude ſtate; the operation being performed chiefly by ſeparating the air, and more ſubtle part of tar, from the reſt of the matter. This was done by putting the matter to be diſtilled into a veſſel, the mouth of which was covered with a wet cloth; and by this the ſteams of aſcending vapour were condenſed, which were afterwards procured by wringing out the cloth. No other diſtillation, beſides this kind, is mentioned by Galen, Oribaſius, Ælian, or Paulus Ægineta.

5 Derivation of the word Alembic.

6 Original method of diſtilling.

The preciſe time is not known when the three mineral acids were firſt diſcovered; though, as no mention is made of them by Geber, Avicenna, or Roger Bacon, it is probable that they were not known in the 12th century.

tury. Raymond Lully gives ſome hints of his being acquainted with the marine acid; whence it is probable, that it was diſcovered towards the end of the 13th, or beginning of the 14th century.

7 Pliny's account of the origin of glaſs-making.

Several chemical facts are related by Pliny, particularly the making of glaſs, which he aſcribes to the following accident. "Some merchants in the Levant, who had nitre on board their ſhip, having occaſion to land, lighted a fire on the ſand in order to prepare their food. To ſupport their veſſels they took ſome of the lumps of nitre with which their ſhip was loaded: and the fire acting on theſe, melted part of them along with the ſand, and thus formed the tranſparent ſubſtance called glaſs, to the great ſurpriſe of the beholders." But it is probable, that the art of glaſs-making was known long before; and it is by no means likely that it took its riſe from ſuch an accident.

8 Alchemy firſt mentioned by Firmicus Maternus.

The next traces we find of chemiſtry are to be extracted from the extravagant purſuits of the *Alchemiſts*, who imagined it poſſible to convert the baſer metals into gold or ſilver. The firſt mention we find of this ſtudy is by Julius Firmicus Maternus, who lived in the beginning of the fourth century, and ſpeaks of it as a well known purſuit in his time. Æneas Blaſius, who lived in the fifth century, likewiſe ſpeaks of it; and Suidas explains the term by telling us, that it is the art of making gold and ſilver. He tells us, that Diocleſian, when perſecuting the Chriſtians, forbad all chemical operations, leſt his ſubjects ſhould diſcover the art of making gold, and thus be induced to rebel againſt him. He ſuppoſes alſo, that the Argonautic expedition was only an attempt to procure a ſkin or parchment, on which was written the *recipe* for making gold. It is a common practice, however, in ſome places where gold is waſhed down in ſmall particles by brooks and rivulets from the mountains, to ſuſpend in the water the ſkins of animals having wool or hair upon them, in order to detain the heavier particles which contain the gold; and this probably gave riſe to the fable of the golden fleece. Suidas, however, who lived as late as the tenth century, deſerves very little credit, eſpecially as alchemy is not mentioned by any ancient author.—The Arabian phyſicians afford the moſt clear and diſtinct evidence concerning alchemy. Avicenna, who lived in the tenth century, is ſaid by a diſciple of his to have wrote upon alchemy; he mentions alſo roſe-water, and ſome other chemical preparations; and in the 12th century we find phyſicians adviſed to cultivate an acquaintance with the chemiſts; and another of the Arabian writers ſay, that the method of preparing roſe-water, &c. was then well known.—From this evidence of the exiſtence of alchemy among the Arabians, with the prefatory article *Al*, to denote the greatneſs of the ſcience, it has been conjectured, that the doctrine of the tranſmutation of metals firſt took its riſe among the Arabians, and was introduced into Europe by means of the Cruſades, and by the rapid conqueſts of the Arabians themſelves in Europe as well as in Aſia and Africa. Europe at that time had been in a ſtate of the greateſt barbarity from the incurſions of the northern nations; but the Arabians contributed to revive ſome of the ſciences, and introduced alchemy among the reſt, which continued till the middle of the 17th century; at which time the extravagance of its profeſſors roſe to the greateſt height.

9 Origin of the fable the Argonauts.

10 Alchemy firſt ſuppoſed to be derived from the Arabians.

11 No credit due to the doctrine of tranſmutation.

Though the pretenſions of the alchemiſts are now univerſally refuted, yet from ſome of the diſcoveries which have been made in chemiſtry, we are even yet in danger of giving ſome credit to the poſſibility of the proceſs of tranſmutation. When we conſider that the metals are bodies compounded of parts which we can take away and reſtore, and that they are cloſely allied to one another in their external appearance, we may be inclined to think favourably even of the projects of the alchemiſts. The very ſeparation of the metals from their ores, the depriving them of their ductility and malleability, and the reſtoration of theſe properties to them at pleaſure, will appear very ſurpriſing to thoſe who are unacquainted with chemiſtry. There are alſo proceſſes of the more difficult kind, by which quickſilver may be produced from metals that are commonly ſolid, as from lead. Some of theſe we find in Boerhaave, Boyle, &c. authors of the greateſt credit, who both ſpeak of the operation and product as realities of which they were convinced by their own experience. Theſe have been urged, not without ſome plauſibility, in favour of the tranſmutation of the imperfect metals into gold; and hence the deluſions of alchemy were not confined to the vain, the ignorant, and the ambitious part of mankind; but many ingenious and learned men, who took pleaſure in the ſtudy of nature, have been ſeduced into this unhappy purſuit. This happened chiefly in Germany, where the variety of mines naturally turned the thoughts of chemiſts principally towards the metals, though the numerous failures of thoſe who had attempted this art ought to have taught them better.

12 Quickſilver produced from lead.

About the beginning of the 16th century, the pretenders to alchemy were very numerous, and a multitude of knaves, who had beggared themſelves in the attempt, now went about to enſnare others, performing legerdemain tricks, and cauſing people believe that they could actually make gold and ſilver. A number of the tricks they made uſe of are to be met with in Lemery. Many books, with the ſame deſign of impoſing upon mankind, were written upon the ſubject of alchemy. They aſſumed fictitious names of the greateſt antiquity, and contained rules for preparing the philoſopher's ſtone; a ſmall quantity of which thrown into a baſe metal ſhould convert the whole into gold. They are wrote in a myſterious ſtyle, without any diſtinct meaning; and though ſometimes proceſſes are clearly enough deſcribed, they are found to be falſe and deceitful upon trial, the products not anſwering the pretenſions of the authors. Their excuſe was, that it was vain to expect plain accounts of theſe matters, or that the books on theſe ſubjects ſhould be written diſtinctly and clearly; that the value of gold was in proportion to its ſcarcity, and that it might be employed to bad purpoſes: they wrote only for the laborious and judicious chemiſts, who would underſtand them provided they made themſelves acquainted with the metals by ſtudy and experience. But in fact, no diſtinct meaning has ever been obtained, and the books have only ſerved to delude and betray a great number of others into the loſs of their *lives*.

But though the alchemiſts failed in the execution of their

13 Chemistry derived some advantages from the labours of the alchemists.

their grand project, we must still own ourselves indebted to them for many discoveries brought to light during the time they vainly spent their labour in the expectation of making gold. Some of these are the methods of preparing spirit of wine, aquafortis, volatile alkali, vitriolic acid, and gun powder. Medicine too was indebted to them for several valuable remedies; whence also it appears that many, who had wasted their time in the vain pursuit of the philosopher's stone, thought of trying some of their most elaborate preparations in the cure of diseases; and meeting with some success, they presumed that diseases were only to be cured by the assistance of chemistry; and that the most elaborate of all its preparations, the philosophers stone, would cure all diseases. Some cures they performed did indeed awaken the attention of physicians; and they introduced the use of opium, which had formerly been accounted poisonous. They succeeded also in the cure of the venereal disease, which had lately made its appearance, and baffled the regular physicians; but the chemists, by giving mercury, put a stop to its ravages, and, thus introduced this valuable article into the materia medica.

14 Account of Paracelsus.

The most famous of the chemical professors was Paracelsus, well known for his arrogance, absurdity, and profligacy. He was bred to the study of medicine; but becoming acquainted with the alchemists, travelled about in the character of a physician, and was at great pains to collect powerful medicines from all quarters. These he used with great freedom and boldness. His success in some cases operated so upon the natural arrogance and self-sufficiency of his disposition, that he formed a design of overturning the whole system of medicine, and supplying a new one from chemistry: and indeed he found but very weak adversaries in the subtle theories of Galen with the refinements of the Arabian physicians, which only prevailed in his time; and he no doubt had some share in banishing that veneration which had been so long entertained for these celebrated personages.

15 History of chemistry since the time of Paracelsus.

16 The science studied by Lord Verulam;

From the time of Paracelsus, chemistry began every where to assume a new face. In Great Britain, Lord Verulam amused himself at his leisure hours with forming plans for promoting the sciences in general, especially those which related to the study of nature. He soon found that chemistry might turn out one of the most useful and comprehensive branches of natural philosophy, and pointed out the means of its improvement. A number of experiments were proposed by him: but he observed, that the views of chemists were as yet only adapted to explain their particular operations on metals; and he observed, that, instead of the abstruse and barren philosophy of the times, it was necessary to make a very large collection of facts, and to compare them with each other very maturely and cautiously, inorder to discover the common causes and circumstances of connection upon which they all depend. He did not, however, make any considerable discoveries, and his works are tedious and disagreeable to the reader.

17 And by Mr Boyle.

A superior genius to Lord Verulam was Mr Boyle, who was born the very day that the former died. His circumstances were opulent, his manners agreeable; he was endowed by nature with a goodness of heart; and his inclination led him entirely to the study of nature, which he was best pleased with cultivating in the way of experiment. He considered the weight, spring, and qualities of the air; and wrote on hydrostatics and other subjects; and was possessed of that happy penetration and ingenuity so well suited to the making of experiments in philosophy, which serves to deduce the most useful truths from the most simple and seemingly insignificant facts. As chemistry was his favourite science, he spared no pains to procure from chemists of greatest note the knowledge of curious experiments, and entertained a number of operators constantly about him. His discoveries are related in an easy style; and though rather copious, suited to the taste of the times in which he lived, and free from that absurd and mysterious air which formerly prevailed in chemical writings: nor does he betray a design of concealing any thing except some particulars which were communicated to him under the notion of secrecy, or the knowledge of which might do more harm than good. It is objected indeed, that he betrays a good deal of credulity with regard to facts which were given on the faith of others, and which may seem incredible; but this proceeded from his candour, and his being little disposed to suspect others. He showed the necessary connection between philosophy and the arts; and said, that by attending the shop of a workman, he learned more philosophy than he had done in the schools for a long time. Thus his writings showed an universal taste for the study of nature, which had now made some advances in the other parts of the world.

18 Chemistry emerges from its obscurity.

Agricola is one of the first and best authors on the subject of metallurgy. Being born in a village in Misnia, a country abounding in mines and metallurgic works, he described them exactly and copiously. He was a physician, and cotemporary with Paracelsus, but of a character very different. His writings are clear and instructive, as those of Paracelsus are obscure and useless. Lazarus Erker, Schinder, Schlutter, Henkel, &c. have also written on metallurgy, and described the art of assaying metals. Anthony Neri, Dr Merret, and the famous Kunkel (who discovered the phosphorus of urine), have described very fully the arts of making glass, enamels, imitations of precious stones, &c.: but their writings, as well as those of succeeding chemists, are not free from the illusions of alchemy: so true it is, that an obstinate and inveterate malady never disappears at once, without leaving traces behind. In a short time, however the alchemical phrenzy was attacked by many powerful antagonists, who contributed to rescue the science of chemistry from an evil which at once disgraced it and retarded its progress. Among these, the most distinguished are Kircher a Jesuit, and Conringius a physician, who wrote with much success and reputation.

19 Royal Society how founded.

About the year 1650 the Royal Society was formed by a number of gentlemen who were unwilling to engage in the civil wars; and being struck with the extensive views of Lord Verulam and Mr Boyle, contributed to the expence of costly experiments. This example appeared so noble, and the design so good, that it has been followed by all the civilized states of Europe, and has met with the protection of their respective sovereigns; and from these chemistry has received considerable improvements. In France, Geoffroy, Lemery, Reaumur, &c. came to be distinguished; and in Germany Margraaf, Pott, and others, have made a conſiderable figure in thoſe ſocieties. Kunckel, Begar, Stahl, and Hoffman, &c. have done great ſervice to ſociety, by introducing new arts, and the numerous improvements they have made.

20 Of the improvements made by different nations in chemiſtry.

The chemiſts who have made a figure in Germany and France are more in number than thoſe whom Britain has produced. In France, the ſociety was encouraged by the ſovereign; and in it they have diveſted themſelves of that myſterious air which was affected in former ages. In Germany, the richneſs of the country, and the great variety of mines, by turning the attention of chemiſts to the metals, have given that alchymiſtical air to their writings which we obſerve in them. The number of thoſe who have applied themſelves to chemiſtry is very ſmall in England, owing to the great improvements made by Sir Iſaac Newton in the ſciences of aſtronomy and optics; which, by turning the general attention that way, has occaſioned what may be called a neglect of chemiſtry. But if their number be inconſiderable, they are by no means inferior in merit and fame. The name of Boyle has always been held in the higheſt eſteem, as well as that of Hales, for the analyſis he has made of the air. Sir Iſaac Newton alone has done more to the eſtabliſhing a rational chemical theory than ever was done before. Of late, the taſte for the ſtudy has became more general, and many uſeful books have appeared; ſo that it is to be hoped they will ſoon excel in this branch of ſcience, as they have done in all the reſt.

## Part I. THEORY of CHEMISTRY.

21 Perfect Theory, what.

According to the definition we have given of this ſcience, the theory of it ought to conſiſt in a thorough knowledge of all the phenomena which reſult from every poſſible combination of its objects with one another, or from expoſing them in all poſſible ways to thoſe ſubſtances which chemiſts have found to be the moſt active in producing a change. So various, however, and ſo widely extended are the objects of chemiſtry (comprehending all terreſtrial bodies whatever), that a knowledge of this kind is utterly unattainable by man. The utmoſt that can be done in this caſe is, to give ſome account of the phenomena which accompany the mixtures of particular ſubſtances, or the appearances they put on when expoſed to heat; and theſe have been already ſo well aſcertained, that they may now be laid down as rules, whereby we may, with a good deal of certainty, judge of the event of our experiments, even before they are made.

22 Objects of Chemiſtry, what.

Here we muſt obſerve, that though the objects of chemiſtry are as various as there are different ſubſtances in the whole ſyſtem of nature, yet they cannot all be examined with equal eaſe. Some of theſe ſubſtances act upon others with great violence; and the greater their activity, the more difficultly are they themſelves ſubjected to a chemical examination. Thus, fire, which is the moſt active body in nature, is ſo little the ſubject of examination, that it hath hitherto baffled the ingenuity of the greateſt philoſophers to underſtand its compoſition. This ſubſtance, therefore, though it be the principal, if not the only *agent* in chemiſtry, is not properly an *object* of it, becauſe it cannot be made a ſubject of any chemical operation.

23 Suppoſition of elements the origin of alchemy.

It hath been cuſtomary to conſider all bodies as compoſed of certain permanent and unchangeable parts called *elements*; and that the end of chemiſtry was to reſolve bodies into theſe elements, and to recompoſe them again by a proper mixture of the elements when ſo ſeparated. Upon this ſuppoſition the alchemiſts went; who, ſuppoſing that all bodies were compoſed of ſalt, ſulphur, and mercury, endeavoured to find out the proportions in which theſe exiſted in gold, and then to form that metal by combining them in a ſimilar manner. Had they taken care to aſcertain the real exiſtence of their elements, and, by mixing them together, compoſed any one metal whatever, though but a grain of lead, the leaſt valuable of them all; their pretenſions would have been very rational and well founded; but as they never aſcertained the exiſtence of ſuch elementary bodies, it is no wonder that their labours were never attended with ſucceſs.

24 Mr Boyle's opinion.

Another ſet of elements which were as generally received, and indeed continue to be ſo in ſome meaſure to this day, are fire, air, earth, and water.—This doctrine of elements was ſtrenuouſly oppoſed by Mr Boyle; who endeavoured to prove, that fire was not an element *per ſe*, but generated merely from the motion of the particles of terreſtrial bodies among one another; that air was generally produced from the ſubſtance of ſolid bodies; and that water, by a great number of diſtillations, was converted into earth. His arguments, however, concerning fire were not at all concluſive; nor does the expulſion of air from fixed bodies prove that any of their ſolid parts were employed in the compoſition of that air; as later diſcoveries have ſhown that air may be abſorbed from the external atmoſphere, and fixed in a great number of ſolid ſubſtances. His aſſertion concerning water deſerves much conſideration, and the experiment is well worth repeating; but it does not appear that he, or any other perſon, ought to have relied upon the experiment which was intended to prove this tranſmutation. The fact was this. Having deſigned to try the poſſibility of reducing water to earth by repeated diſtillations, he diſtilled an ounce of water three times over himſelf, and found a ſmall quantity of earth always remaining. He then gave it to another, who diſtilled it 197 times. The amount of earth from the whole diſtillations was ſix drams, or $\frac{3}{4}$ths of the quantity of water employed; and this earth was fixed, white, and inſoluble in water.—Here it is evident, that great ſuſpicions muſt lie againſt the fidelity of the unknown operator, who no doubt would be wearied out with ſuch a number of diſtillations. The affair might appear trivial to him; and as he would perhaps know to which ſide Mr Boyle's opinion inclined, he might favour it, by mixing ſome white earth with the water. Had the experiment been tried by Mr Boyle's own hand, his known character would have put the matter beyond a doubt.

The decompoſition of water, however, in another way, by the combination of one part of it with the phlogistic, and another with the earthy part of a metal, is now well ascertained, and the experiments which led to the discovery are treated of under the articles AEROLOGY and WATER.

25 Existence of elements disputed.

Even the existence of earth as an element appears as dubious as that of the others; for it is certain that there is no species of earth whatever, from which we can produce two dissimilar bodies, by adding their other component parts.—Thus, the earth of alum has all the characters of simplicity which we can desire in any terrestrial substance. It is white, insipid, inodorous, and perfectly fixed in the fire; nevertheless, it seems to be only an element of that particular body called *alum;* for though alum is composed of a pure earth and vitriolic acid joined together, and Epsom salt and selenite are both composed of a pure earth combined with the same acid; yet by adding oil of vitriol to the earth of alum, in any possible way, we shall never be able to form either Epsom salt or selenite. In like manner, though all the imperfect metals are composed of inflammable matter joined with an earthy basis; yet by adding to earth of alum any proportion we please of inflammable matter, we shall never produce a metal; and what is still more mortifying, we can never make the earthy basis of one metallic substance produce any other metal than that which it originally composed.

26 Elements necessarily invisible.

A little consideration upon the subject of elements will convince us, not only that no such bodies have ever yet been discovered, but that they never will; and for this plain reason, that they must be in their own nature invisible.—The component parts of any substance may with propriety enough be called the elements of that substance, as long as we propose carrying the decomposition no farther; but these elements have not the least property resembling any substance which they compose. Thus, it is found that the compound salt called *sal ammoniac,* is formed by the union of an acid and an alkali: we may therefore properly enough call these two the elements of sal ammoniac; but, taken separately, they have not the least resemblance to the compound, which is formed out of them. Both the acid and alkali are by themselves so volatile as to be capable of dissipation into an invisible vapour by the heat of one's hand; whereas, when joined together, they are so fixed as almost to endure a red heat without going off. If, again, we were to seek for the elements of the acid and alkali, we must not expect to find them have any properties resembling either an acid or an alkali, but others quite different. Any common element of all bodies must therefore be a substance which has no property similar to any other in the whole system of nature, and consequently must be imperceptible.

27 Supposition concerning phlogiston.

To the abovementioned four elements, viz. fire, air, earth, and water, a kind of *fifth* element has generally been added, but not usually distinguished by that name, though it has apparently an equal, if not a greater, right to the title of an *element* than any of the others. This substance is called the *phlogiston,* or inflammable principle; on which the ignition of all bodies depends. The existence of this element was first asserted by Stahl, and from him the opinion has been derived to other chemists: but of late a new doctrine was broached by M. Lavoisier, who denies the existence of phlogiston altogether. Though none of these substances therefore are properly the objects of chemistry, yet as they have so much ingrossed the attention of modern chemists, we shall here give an account of the most remarkable theories that have appeared concerning them.

Of the Element of Fire.

### SECT. I. *Of the Element of Fire.*

28 Two general theories of heat.

THE opinions concerning the element of fire may be divided into two general classes; the one considering it as an effect, the other as a cause. The former is maintained by Lord Bacon, Mr Boyle, and Sir Isaac Newton; whose respectable names for a long time gave such a sanction to this theory, that it was generally looked upon as an established truth. Some learned men, however, among whom was the great Dr Boerhaave, always dissented, and insisted that fire was a fluid universally diffused, and equally present in the frozen regions of Nova Zembla as in a glass-house furnace, only that in the latter its motion made it conspicuous; and by setting it in motion in the coldest parts of the world, its previous existence there would be equally demonstrable as in the furnace abovementioned.

29 Lord Bacon's definition of heat.

Lord Bacon defines heat, which he uses as a synonymous term with fire, to be an expansive undulatory motion in the particles of a body, whereby they tend with some rapidity towards the circumference, and also a little upwards. Hence, if in any natural body you can excite a motion whereby it shall expand or dilate itself, and can repress and direct this motion upon itself in such a manner that the motion shall not proceed uniformly, but obtain in some parts and be checked in others, you will generate heat or fire.

30 Mr Boyle's opinion

The same opinion is supported by Mr Boyle in the following manner: "The production of heat discovers nothing, either in the agent or patient, but motion, and its natural effects. When a smith briskly hammers a small piece of iron, the metal thereby becomes exceedingly hot: yet there is nothing to make it so, except the motion of the hammer impressing a vehement and variously determined agitation on the small parts of the iron; which, being a cold body before, grows hot by that superinduced motion of its small parts: first, in a more loose acceptation of the word, with regard to some other bodies, in comparison of which it was cold before; then sensibly hot, because the motion in the parts of the iron is greater than that in the parts of our fingers; at the same time that the hammer and anvil, by which the percussion is communicated, may, on account of their magnitude, remain cold. It is not necessary, therefore, that a body should itself be hot in order to communicate heat to another."

31 Sentiments of Sir Isaac Newton.

The arguments made use of by Sir Isaac Newton are not intended positively to establish any kind of theory relating to fire, but are to be found in a conjecture, published at the end of his Treatise on Optics, concerning the nature of the sun and stars. "Large bodies (he observes) preserve their heat the longest, their parts heating one another; and why may not great, dense, and fixed bodies, when heated beyond a certain degree, emit light so copiously, as, by the emission and reaction of it, and the reflections and refractions within the pores, to grow continually hotter, till they arrive at such a period of heat as is that of the sun? Their parts

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parts may be further preſerved from fuming away, not only by their fixity, but by the vaſt weight and denſity of the atmoſphere incumbent on them, ſtrongly compreſſing them, and condenſing the vapours exhaled from them. Thus we ſee, that warm water, in an exhauſted receiver, ſhall boil as vehemently as the hotteſt water expoſed to the air: the weight of the incumbent atmoſphere in this latter caſe keeping down the vapours, and hindering the ebullition till it has received its utmoſt degree of heat. Thus alſo a mixture of tin and lead, put on a red hot iron *in vacuo*, emits a fume and flame: but the ſame mixture in the open air, by reaſon of the incumbent atmoſphere, does not emit the leaſt ſenſible flame." In conſequence of theſe experiments, Sir Iſaac conjectures, that there is no eſſential diſtinction betwixt fire and groſs bodies; but that they may be converted into one another. "Fire (he ſays) is a body heated ſo hot as to emit light copiouſly; for what (ſays he) is a red hot iron but fire?"

32 Fire now generally allowed to be an element *per ſe*.

The hypotheſes of theſe great men produced long and violent diſputes, which were never deciſively ſettled: The diſcoveries in electricity, however furniſhed ſuch additional ſtrength to the followers of Dr Boerhaave, that fire is now believed to be an element and fluid diſtinct from all others, by at leaſt as many as eſpouſe the contrary ſyſtem; but the queſtion is not decided, Whether the fire itſelf is to be conſidered as the agent? or, Whether its action is to be derived from the principles of attraction and repulſion, the natural agents ſuppoſed to influence other material

33 Two other theories inſtituted.

ſubſtances? This has produced two other ſyſtems of a kind of mixed nature, in which heat or fire is conſidered as a ſubſtance diſtinct from all others, but which acts in other bodies according to its *quantity*. Theſe ſyſtems have been promulgated by Dr Black of Edinburgh and Dr Irvine of Glaſgow.

34 In what they differ from the former.

They differ from the opinions of Mr Boyle, Lord Bacon, and Sir Iſaac Newton, in ſuppoſing heat to be a fluid diſtinct from all other material ſubſtances; and they alſo differ from the hypotheſis of Dr Boerhaave, Lemery, and others, in ſuppoſing different terreſtrial ſubſtances to be hot according to the *quantity* of fluid contained, and not according to the force with which it moves in them.

35 General account of Dr Black's and Dr Irvine's theories.

Dr Black is of opinion that *heat*, which he ſeems to make ſynonymous with fire, exiſts in two different ſtates; in one of which it affects our ſenſes and the thermometer, in the other it does not. The former therefore he calls *ſenſible* heat, the later *latent* heat. On theſe principles he gives the only ſatisfactory explanation of the phenomena of evaporation and fluidity that has yet appeared, as ſhall afterwards be more fully explained. At preſent we ſhall only obſerve, that, according to the theory of Dr Black, heat or fire itſelf ſeems to be the agent; but, according to that of Dr Irvine, as far as we can gather it from the treatiſes of Dr Crawford and others, the principles of attraction and repulſion are the agents by which heat, as well as other bodies, is influenced. Thus, on the principles of Dr Black, we ſay, that water is converted into vapour by a quantity of heat entering into it in a *latent* ſtate, and thereby rendering it ſpecifically lighter than the atmoſphere; according to the principles of Dr Irvine, we ſay, that water is converted into vapour by having its capacity for attracting heat from the atmoſphere increaſed. So that, according to the former, the abſorption of heat is the *cauſe*; according to the latter, the *effect*, of its converſion into vapour.

Of the Element of Fire.

36 Dr Irvine's theory explained by Dr Crawford.

Dr Crawford, in his Treatiſe on Heat, publiſhed in 1788, informs us, that *heat*, in the philoſophical ſenſe of the word, has been uſed to expreſs what is frequently called the *element of fire*, in the abſtract, without regard to the peculiar effects which it may produce in relation to other bodies.

37 Abſolute heat defined.

This, with Dr Irvine, he calls *abſolute* heat; and the external cauſe, as having a relation to the effects it produces, he calls *relative* heat. "From this view of the matter (ſays he), it appears, that *abſolute heat* expreſſes, in the abſtract, that *power* or *element* which, when it is preſent to a *certain* degree, excites in all animals the ſenſation of heat; and *relative* heat expreſſes the ſame power, conſidered as having a relation to the effects by which it is known and meaſured.

83 Relative heat,

39 How divided.

"The effects by which heat is known and meaſured are three; and therefore relative heat may admit of three ſubdiviſions. 1. This principle is known by the peculiar ſenſations which it excites in animals. Conſidered as exciting thoſe ſenſations, it is called *ſenſible* heat. 2. It is known by the effect which it produces upon an inſtrument that has been employed to meaſure it, termed a *thermometer*. This is called the *temperature of heat in bodies*. 3. It has been found by experiment, that in bodies of different kinds the quantities of abſolute heat may be unequal, though the temperatures and weights be the ſame. When the principle of heat is conſidered relatively to the whole quantity of it contained in bodies of different kinds, but which have equal weights and temperatures, I ſhall term it *comparative heat*. If, for example, the temperatures and weights being the ſame, the whole quantity of heat in water be four times as great as that of antimony, the comparative heats of theſe ſubſtances are ſaid to be as four to one."

40 Comparative heat defined.

41 Experiments by which Dr Black was led to the diſcovery of latent heat.

In order to have a proper conception of what is meant by a difference in abſolute heat, when the temperatures are the ſame, it will be neceſſary to relate ſome experiments, by which Dr Black was firſt led to the diſcovery of latent heat. He obſerves, that when two equal maſſes of the ſame matter, heated to different degrees, are mixed together, the heat of the mixture ought to be an arithmetical mean betwixt the two extremes. This, however, only takes place on mixing hot and cold water together; but if inſtead of cold water we take ice, the caſe is remarkably different.

42 A quantity of heat loſt in the melting of ice.

Here the temperature of the mixture is much below the arthmetical mean, and a quantity of heat is apparently loſt. Now we know that the temperature of ice newly frozen is generally 32 degrees of Fahrenheit; ſuppoſing therefore the temperature of the water which diſſolves it to be 120, the arithmetical mean is 71; but if the mixture indicates a temperature only of 60°, then we muſt ſuppoſe that the ice contained 11° of heat leſs than was indicated by the thermometer; and conſequently, that water at 32° contains 11° more of abſolute heat than ice at 32°.

43 Great quantity of heat produced by the condenſation of vapour.

The ſame thing is made ſtill more evident from the condenſation of vapour. The fluid of water is not capable of ſuſtaining a great degree of heat; and 212° of Fahrenheit is the utmoſt it can be made to bear, without an extraordinary degree of preſſure, as in Pa-

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pin's digester, or the admixture of saline substances: the temperature of the steam emitted by it therefore never can exceed 212°, except in the cases just mentioned; and it is often capable of bearing a great degree of cold without being condensed. When the condensation takes place at last, however, a very considerable degree of heat is always produced; and Dr Black has shown, that, in the condensation of steam by the refrigeratory of a common still, as much heat is communicated to the water in the refrigeratory as would be sufficient to make the water which comes over as hot as red hot-iron, were it all to exist in a sensible state. His method of making the calculation is very easy. For, supposing the refrigeratory to contain 100 pounds of water, and that one pound has been distilled; if the water in the refrigeratory has received 10 degrees of heat, we know that the distilled pound has parted with 1000. If in passing through the worm of the refrigeratory, it has been reduced to the temperature of 50° of Fahrenheit, having been at 212° when it entered it, then it has lost only 162° of sensible heat; all the rest communicated to the water of the refrigeratory amounting to more than 800°, having been contained in a latent state, and such as could not then affect the thermometer. This experiment was tried by Mr Watt in a manner still more striking, by a distillation of water *in vacuo*. Thus the steam, freed from the pressure of the atmosphere, could not conceive such a degree of sensible heat as in the common method of distilling. It came over therefore with a very gentle warmth, scarce more than what the hand could bear; nevertheless it had absorbed as much heat as though the distillation had been performed in the common way; for the refrigeratory had 1000 degrees of heat communicated to it.

44 Dr Black's method of calculating it.

45 Mr Watt's experiment on the distillation of water *in vacuo*

46 Difference of absolute heat in different fluids.

The difference of absolute heat is likewise perceptible betwixt any two bodies of different density, water and mercury for instance: and in comparing these, it will always be found that the thinnest fluids contain the greatest quantity of absolute heat; as water more than mercury, spirit of wine, more than water, ether more than spirit of wine, and air more than any of them. Dr Black having brought equal bulks of mercury and water, the former to a temperature of 50 degrees higher than the latter, found that, on mixture, there was a gain of only 20 degrees above the original; but on reversing the experiment, and heating the water 50 degrees above the mercury, there was a gain of 30 degrees on the whole. "Hence (says Dr Cleghorn in his thesis *de Igne*) it appears, that the quantity of heat in water is to that in mercury, when both are of equal temperatures, as 3 to 2." Dr Crawford, however, tells us, that "the same quantity of heat which raises a pound of water one degree, will raise a pound of mercury 28 degrees; whence it follows, that the comparative heat of water is to that of mercury as 28 to 1: and consequently, the alterations which are produced in the temperatures of bodies by given quantities of absolute heat, may properly be applied as a measure of their comparative heats; the alterations of temperature and the comparative heats being reciprocally proportional to one another.

47 Thinnest fluids contain the greatest quantity of heat.

48 Great difference betwixt the calculations of Drs Cleghorn and Crawford.

49 Crawford's account of sensible heat.

"Sensible heat (continues Dr Crawford) depends partly on the state of the temperature, and partly on that of the organ of feeling; and therefore if a variation be produced in the latter, the sensible heat will be different, though the temperature continue the same. Thus water at the temperature of 62° of Fahrenheit appears cold to a warm hand immersed in it; but on the contrary, that fluid will appear warm if a hand be applied to it which has a lower degree of heat than 62°. For this reason, the thermometer is a much more accurate measure of heat than the senses of animals. As long, however, as the organs remain unchanged, the sensible heat is in proportion to the temperature; and therefore those terms have generally been considered as synonymous. On this subject Dr Reid observes, that until the ratio between one temperature and another be ascertained by experiment and induction, we ought to consider temperature as a measure which admits of degrees, but not of ratios; and consequently ought not to conclude, that the temperature of one body is double or triple to that of another, unless the ratio of different temperatures were determined. Nor ought we to use the expressions of a *double* or *triple* temperature, those being expressions which convey no distinct meaning until the ratio of different temperatures be determined."

50 Dr Reid's observation concerning temperatures.

51 Difference betwixt the calculations of Drs Crawford and Black.

In making experiments on the comparative quantities of heat in different bodies, our author chooses rather to use equal *weights* than equal *bulks* of the substances to be compared. Thus he found the comparative heat of water to be to that of mercury as 28 to 1 by weight, and 2 to 1 by bulk; which differs very considerably from the conclusion of Dr Black, who makes it only as 3 to 2, as has been already mentioned.

52 Capacities for containing heat explained.

From the differences observed in the quantities of absolute heat contained in different bodies, our author concludes, that "there must be certain essential differences in the nature of bodies; in consequence of which, *some* have the power of collecting and retaining that element in greater quantity than *others*." These different powers he calls the *capacities* for containing heat. Thus, if we find by experiment that a pound of water contains four times as much absolute heat as diaphoretic antimony, when at the same temperature, the capacity of water for containing heat is said to be to that of animony as 4 to 1.

53 How the capacity, temperature, and absolute heat, are to be distinguished.

"The temperature, the capacity for containing heat, and the absolute heat contained, may be distinguished from each other in the following manner.

"The capacity for containing heat, and the absolute heat contained, are distinguished as a force distinct from the subject upon which it operates. When we speak of the capacity, we mean a power inherent in the heated body; when we speak of the absolute heat, we mean an unknown principle which is retained in the body by the operation of this power; and when we speak of the temperature, we consider the unknown principle as producing certain effects upon the thermometer.

"The capacity for containing heat may continue unchanged, while the absolute heat is varied without end. If a pound of ice, for example, be supposed to retain its solid form, the quantity of its absolute heat will be altered by every increase or diminution of its sensible heat: but as long as its form continues the same, its capacity for receiving heat is not affected by an

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an alteration of temperature, and would remain unchanged though the body were wholly deprived of its heat."

54 Crawford's opinion concerning heat in the abstract.

In the course of his work, Dr Crawford observes, that "he has not entered into the inquiry which has been so much agitated among the English, the French, and the German philosophers, Whether heat be a *substance* or a *quality*? In some places indeed he has used expressions which seem to favour the former opinion; but his sole motive for adopting these was, because the language seemed to be more simple and natural, and more consonant to the facts which had been established by experiment. At the same time, he is persuaded that it would be a very difficult matter to reconcile many of the phenomena with the supposition that heat is a *quality*. It is not easy to conceive, upon this hypothesis, how heat can be absorbed in the processes of fusion, evaporation, combustion; how the quantity of heat in the air can be diminished, and that in the blood increased, by respiration, though no sensible heat or cold be produced.

"Whereas, if we adopt the opinion that heat is a distinct substance, or an element *sui generis*, the phenomena will be found to admit of a simple and obvious interpretation.

55 Fire contained in bodies partly by its attraction to them, and partly by the pressure of the external fluid.

"Fire will be considered as a principle; which is distributed in various proportions throughout the different kingdoms of nature. The mode of its union with bodies will resemble that particular species of union, wherein the elements are combined by the joint forces of pressure and attraction. Of this kind is the combination of fixed air and water; for fixed air is retained in water partly by its attraction for that fluid, and partly by the pressure of the external air; and if either of these forces be diminished, a portion of the fixed air escapes. In like manner, it may be conceived that elementary fire is retained in bodies, partly by its attraction to these bodies, and partly by the action of the surrounding heat; and in that case a portion of it will be disengaged, either by diminishing the attractive force, or by lessening the temperature of the circumambient medium. If, however, fire be a substance which is subject to the laws of attraction, the mode of its union with bodies seems to be different from that which takes place in chemical combination: for, in chemical combination, the elements acquire new properties, and either wholly or in part lose those by which they were formerly characterized. But we have no sufficient evidence for believing that fire, in consequence of its union with bodies, does, in any instance, lose its distinguishing properties."

56 Dr Berkenhout's opinion concerning the nature of heat.

Dr Berkenhout, in his first Lines of the Theory and Practice of Philosophical Chemistry, informs us, that "heat, or the *matter of heat*, is by Scheele and Bergman substituted for fire, which they believe to be the action of heat when increased to a certain degree. The first of these celebrated chemists believed this *matter of heat* to be a compound of phlogiston and pure air. He was certainly mistaken. It seems more philosophical to consider heat as an *effect*, of which fire is the sole cause.

57 His division of fire into fixed and volatile.

"Heat I consider not as a distinct substance, but as an effect of fire, fixed or volatile; in both which states fire seems to exist in all bodies, solid and fluid. Fixed fire I believe to be a constituent part of all bodies, and their specific heat to depend on the quantity of fixed fire in each. This fixed, this latent fire, cannot be separated from the other constituent parts of bodies but by their decomposition: it then becomes volatile and incoercible. If this hypothesis be true, fire exists, in all natural bodies that contain phlogiston, in three different states: 1. In that volatile state in which it perpetually fluctuates between one body and another. 2. Combined with an acid, probably in the form of fixed inflammable air or phlogiston. 3. Uncombined and fixed, as a constituent principle, determining the specific heat of bodies.

58 Pure or volatile fire defined.

"Pure (or volatile) fire is distinguished by the following properties. 1. It is essentially fluid, invisible, and without weight. 2. It is the immediate cause of all fluidity. 3. It penetrates and pervades all bodies on the surface of the earth, and as far beneath the surface as hath hitherto been explored. Water hath never been found in a congealed state in the deepest mines. 4. It has a constant tendency to diffuse itself equally through all bodies, howsoever different in point of density. A marble slab, a plate of iron, a decanter of water, and a lady's muff, at the same distance from the fire, and other external circumstances, being equal, possess an equal degree of heat, which is precisely that of the atmosphere in which they stand. 5. It is perpetually in motion from one body to another, and from different parts of the same body, because external circumstances are continually varying. 6. In fluctuating from one body to another, it produces a constant vibration of their constituent parts; for all bodies expand and contract in proportion to the quantity of fire they contain. 7. Accumulated beyond a certain quantity, it effects the dissolution of bodies, by forcing their constituent parts beyond the sphere of mutual attraction, called the *attraction of cohesion*, which is the cause of solidity. Hence the sovereign agency of fire in chemical operations."

59 Dr Crawford's definition of fire.

Dr Crawford, besides the opinions already quoted, tells us, that fire, in the vulgar acceptation of the word, expresses a certain degree of heat accompanied with light; and is particularly applied to that heat and light which are produced by the inflammation of combustible bodies. But as heat, when accumulated in a sufficient quantity, is constantly accompanied with light; or, in other words, as fire is always produced by the increase of heat, philosophers have generally considered these phenomena as proceeding from the same cause: and have therefore used the word *fire* to express that unknown principle, which, when it is present to a certain degree, excites the sensation of heat alone; but, when accumulated to a greater degree, renders itself obvious both to the sight and touch, or produces heat accompanied with light. In this sense, the element of fire signifies the same thing with *absolute heat*.

Having premised these general definitions and remarks, he gives the properties of heat in the following words:

60 Heat has a tendency to diffuse itself equally over bodies.

"I. Heat has a constant tendency to diffuse itself over all bodies till they are brought to the same temperature. Thus it is found by the thermometer, that if two bodies of different temperatures are mixed together, or placed contiguous, the heat passes from the one to the other till their temperatures become equal; and

and that all inanimate bodies, when heated and placed in a cold medium, continually loſe heat, till in proceſs of time they are brought to the ſtate of the ſurrounding medium.

“ From this property of heat it follows, that the various claſſes of bodies throughout the earth, if they were not acted upon by external cauſes, would at length, arrive at a common temperature when the heat would become quieſcent; in like manner as the waters of the ocean, if not prevented by the winds and by the attractions of the ſun and moon, would come to an equilibrium, and would remain in a ſtate of reſt. But as cauſes continually occur in nature to diſturb the balance of heat as well as that of the waters of the ocean, thoſe elements are kept in a conſtant fluctuation.

61 It is contained in conſiderable quantity in all bodies.

“ II. Heat is contained in conſiderable quantities in all bodies when at the common temperature of the atmoſphere.

62 Great degree of cold at Glaſgow,

“ From the intereſting experiments which were made on cold by Mr Wilſon, we learn, that at Glaſgow, in the winter of the year 1780, the thermometer on the ſurface of ſnow ſunk 25 degrees below the beginning of Fahrenheit's ſcale.

63 In Siberia, and at Hudſon's bay.

“ We are told by Dr Pallas, that in the deſerts of Siberia, during a very intenſe froſt, the mercury was found congealed in thermometers expoſed to the atmoſphere, and a quantity of that fluid in an open bowl placed in a ſimilar ſituation, at the ſame time became ſolid. The deciſive experiments of Mr Hutchins at Hudſon's Bay prove, that the freezing point of mercury is very nearly 40° below the *zero* (or 0°) of Fahrenheit. From which it follows, that at the time of Dr Pallas's obſervation, the atmoſphere in Siberia muſt have been cooled to minus 40. By a paper lately tranſmitted to the Royal Society we are informed, that the ſpirit-of-wine thermometer in the open air at Hudſon's Bay fell to — 42 in the winter of 1785; and from the ſame communication we learn, that by a mixture of ſnow and vitriolic acid, the heat was ſo much diminiſhed, that the ſpirit of wine ſunk to — 80, which is 112 below the freezing point of water.

64 Quantity of heat limited in all bodies.

“ Hence it is manifeſt, that heat is contained in conſiderable quantities in all bodies when at the common temperature of the atmoſphere. It is plain, however, that the quantity inherent in each individual body is limited. This, I think, muſt be admitted, whatever be the hypotheſis which we adopt concerning the nature of heat; whether we conceive it to be a force or power belonging to bodies, or an elementary principle contained in them. For thoſe who conſider heat as an element, will not ſuppoſe that an unlimited quantity of it can be contained in a finite body; and if heat be conſidered as a force or power, the ſuppoſition that finite bodies are actuated by forces or powers which are infinite is equally inadmiſſible.

65 Bodies univerſally expanded by heat.

“ To place this in another light, we know that bodies are univerſally expanded by heat, excepting in a very few inſtances, which do not afford a juſt objection to the general fact; becauſe, in thoſe inſtances, by the action of heat a fluid is extricated that previouſly ſeparated the particles from each other. Since, therefore, heat is found to expand bodies in the temperatures which fall within the reach of our obſervation, we may conclude that the ſame thing takes place in all temperatures.”

66 Expanſion of mercury, &c. proportionable to the degrees of heat.

Our author, by a ſet of very accurate and laborious experiments, determines that the expanſions in mercury and ſome other fluids are proportionable to the quantities of heat applied; “ from which (ſays he) it is manifeſt, that the quantities of heat in bodies are limited, becauſe an infinite heat would produce an infinite expanſion.

“ It is manifeſt, that the number of degrees of ſenſible heat, as meaſured by the thermometer, and eſtimated from the beginning of the ſcale, muſt be the ſame in all bodies which have a common temperature; for by the firſt general fact it is proved, that heat has a conſtant tendency to diffuſe itſelf uniformly over bodies till their temperatures become equal. From which it may be inferred, that if a quantity of heat were added to bodies abſolutely cold, the ſame uniform diffuſion would take place; and that if a thermometer, altogether deprived of its heat, were applied to ſuch bodies, it would be equally expanded by them, the whole of the ſenſible heat which they had acquired being indicated by that expanſion.

67 Homogeneous bodies of the ſame temperature, contain quantities of heat proportionable to thoſe of their matter.

“ III. If the parts of the ſame homogeneous ſubſtance have a common temperature, the quantity of abſolute heat will be proportional to the bulk or quantity of matter. Thus the quantity of abſolute heat in two pounds of water is double that which is contained in one pound when at the ſame temperature.

“ IV. The dilatations and contractions of the fluid in the mercurial thermometer are nearly proportional to the quantities of abſolute heat which are communicated to the ſame homogeneous bodies, or ſeparated from them, as long as they retain the ſame form. Thus the quantity of heat required to raiſe a body four degrees in temperature by the mercurial thermometer, is nearly double that which is required to raiſe it two degrees, four times that required to raiſe it one degree, and ſo in proportion.”

68 Mr Kirwan's opinion concerning fire.

Thus we find, that Dr Black, Dr Irvine, Dr Crawford, and Dr Berkenhout, agree in ſpeaking of fire or heat as a fluid ſubſtance diſtinct from all other bodies. Mr Kirwan, in his Treatiſe of Phlogiſton, agrees in the ſame opinion. “ Some (ſays he) have thought, that I ſhould have included the matter of heat, or elementary fire, in the definition of inflammable air; but as fire is contained in all corporeal ſubſtances, to mention it is perfectly needleſs, except where bodies differ from each other in the quantity of it they contain.”

69 Mr Cavendiſh's opinion that it is not a diſtinct ſubſtance.

On the other hand, Mr Cavendiſh, Phil. Tranſ. lxxiv. P. 141. tells us, that “ he thinks it more likely that there is no ſuch thing as elementary heat:” but, as he gives no reaſon for this opinion, it ſeems probable that the greater part of philoſophers either poſitively believe that heat is an elementary fluid diſtinct from all others, or find themſelves obliged to adopt a language which neceſſarily implies it.

70 Difficulty in defining the phraſe *quantity of heat*.

The only difficulty which now remains therefore is, to affix a proper idea to the phraſe *quantity of heat*, which we find univerſally made uſe of, without any thing to determine our opinions concerning it.

71 This phraſe cannot be uſed in the common acceptation of the word with regard to fire.

That we cannot ſpeak of a *quantity* of fire or heat in the ſame ſenſe as we ſpeak of a quantity of water or any other fluid is evident, becauſe we can take away the quantity of water which any ſubſtance contains, but cannot do ſo with heat. Nay, in many caſes we are ſure, that a ſubſtance very cold to the touch does yet

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yet contain a very considerable quantity of heat. The vapour of water, for instance, may be made much colder than the usual temperature of the atmosphere without being condensed, when at the same time we are certain that it contains a great quantity of heat; and the same may be said of water, which, in the act of freezing, throws out a great quantity of heat without becoming colder; and in the act of melting absorbs as much without becoming warmer. It is not therefore by the mere presence or absence of this fluid that we can determine the real quantity of this fluid; nor does it appear that the word *quantity* can be at all accurately applied to the element itself, because we have no method of measuring it.

72 Dr Cleghorn's opinion.

Dr Cleghorn, in his inaugural dissertation *De Igne* throws some light on this subject, by observing, that "the thermometer shows only the quantity of heat *going out* of a body, not that which is really contained in it:" and he also insists, that "we can neither assent to the opinion of Dr Boerhaave, who supposed that heat was distributed among bodies in proportion to their bulks; nor to the hypothesis of others, who imagined that they were heated in proportion to their densities." But in what proportion, then, are they heated; or how are we to measure the *quantity* which they really contain, seeing the thermometer informs us only of what they part with?

73 The latent heat of bodies cannot be measured.

As this point is by no means ascertained, we cannot form a direct idea concerning the absolute quantity of heat contained in any body; and therefore when we speak of quantities of this fluid, we must in fact, if we mean any thing, think of the sensible quantity flowing out of them; and though we should suppose the whole of this sensible heat to be removed, it would still be impossible for us to know how much remained in a latent state, and could not be dissipated. This difficulty will still appear the greater, if with Dr Cleghorn and others we suppose the fluid of heat to be subject to the laws of attraction and repulsion. This gentleman supposes, that the particles of heat (like the particles of electric fluid according to the Franklinian hypothesis) are repulsive of one another, but attracted by all other substances. "If any body (says he), heated beyond the common temperature of the air, is exposed to it, the heat flows out from it into the atmosphere, and diffuses itself equally all around till the air becomes of the same temperature with itself. The same happens to bodies suspended *in vacuo*. Hence it is justly concluded, that there exists between the particles of heat a repulsive power, by which they mutually recede from each other. Notwithstanding this repulsive power, however, the quantities of heat contained in different substances, even of the same temperature, are found to be altogether different; and from Dr Black's experiments it now appears, that the quantity of heat is scarce ever the same in any two different bodies: and hence we may conclude, that terrestrial bodies have a power of attracting heat, and that this power is different in different substances.—From these principles it evidently follows, that heat is distributed among bodies directly in proportion to their attracting powers, and inversely according to the repulsive power between the particles of heat themselves. Such is the distribution of heat among bodies in the neighbourhood of each other; and which is called the *equilibrium of heat*, because the thermometer shows no difference of temperature among them. For seeing the heat is distributed according to the attracting power of each, the thermometer having also a proper attraction of its own, can show no difference in the attracting power of each; for which reason all bodies in the neighbourhood of each other are soon reduced to the same temperature."

74 Dr Cleghorn's hypothesis concerning fire.

75 Equilibrium of heat defined.

76 The quantity of heat cannot be determind by this hypothesis.

If we assent to Dr Cleghorn's hypothesis, the quantity of heat contained in any substance depends, in the first place, on the attracting power of that substance, which is altogether unknown; and, in the second place, on the repulsive powers of the particles of heat themselves, which are equally unknown. To determine the *quantity*, therefore, must be impossible. Neither will the mixture of two different fluids, as in Dr Black's experiments, assist us in the least; for though water, heated more than mercury, communicates a greater heat to that fluid than the latter does to water; this only shows that water more readily parts with some part of the heat it contains than mercury does, but has not the least tendency to discover the quantity contained in either.

77 Dr Crawford's method of determining the proportional quantities of heat.

Dr Crawford, as we have already seen, calls the *degree*, or, if we may vary the phrase, the *quantity of power* or *element (fluid*, if we may substitute a synonymous word) existing or present in any body, its *absolute heat*; and lays down a rule for determining the proportional quantities of heat in different bodies. "It will appear (says he) from the experiments afterwards recited, that if a pound of water and a pound of diaphoretic antimony have a common temperature, the quantity of absolute heat contained in the former is nearly four times that contained in the latter."—The manner in which he illustrates this is as follows.

"If four pounds of diaphoretic antimony at 20 be mixed with one pound of ice at 32, the temperature will be nearly 26: the ice will be cooled six degrees, and the antimony heated six. If we reverse the experiment, the effect will be the same. That is, if we take six degrees of heat from four pounds of antimony, and add it to a pound of ice, the latter will be heated six degrees. The same quantity of heat, therefore, which raises a pound of ice six degrees, will raise four pounds of antimony six degrees.

"If this experiment be made at different temperatures, we shall have a similar result. If, for example, the antimony at 15, or at any given degree below the freezing point, be mixed with the ice at 32, the heat of the mixture will be the arithmetical mean between that of the warmer and colder substance. And since the capacities of bodies are permanent as long as they retain the same form, we infer, that the result would be the same if the antimony were deprived of all its heat, and were mixed with the ice at 32. But it is evident, that in this case the ice would communicate to the antimony the half of its absolute heat. For if 200 below frost be conceived to be the point of total privation, the antimony will be wholly deprived of its heat when cooled to 200 degrees below 32, and the heat contained in the ice when at 32 will be 200 degrees. If we now suppose them to be mixed together, the temperature of the mixture will be half the excess of the hotter above the colder, or the ice will

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be cooled 100 degrees and the antimony heated 100. The one half of the heat, therefore, which was contained in the ice previous to the mixture will be communicated to the antimony; from which it is manifest, that after the mixture the ice and antimony must contain equal quantities of absolute heat.

"To place this in another light, it has been proved, that the same quantity of heat which raises a pound of ice six degrees will raise four pound of antimony six degrees. And as the capacities of bodies, while they retain the same form, are not altered by a change of temperature; it follows, that the same quantity of heat which raises the ice 200 degrees, or any given number of degrees, will raise the antimony an equal number of degrees.

"A pound of ice, therefore, and four pounds of antimony, when at the same temperature, contain equal quantities of absolute heat. But it appears from the third general fact (n° 67.), that four pounds of antimony contain four times as much absolute heat as one pound of antimony; and hence the quantity of absolute heat in a pound of ice is to that in a pound of antimony as four to one."

78 His method insufficient.

From this quotation it is evident, that, notwithstanding all the distinctions which Dr Crawford has laid down betwixt absolute heat and temperature, it is only the *quantity* of the latter that can be measured; and all that we can say concerning the matter is, that when certain bodies are mixed together, some of them part with a greater quantity of heat than others; but how much they *contain* must remain for ever unknown, unless we can fall on some method of measuring the quantity of heat as we do that of any other fluid.

79 Nicholson's account of the theories of heat.

Mr Nicholson, who has collected the principal opinions on the subject of heat, seems undetermined whether to believe the doctrine of Boyle or of Boerhave on the subject. "There are two opinions (says he) concerning heat. According to one opinion, heat consists in a vibratory motion of the parts of bodies among each other, whose greater or less intensity occasions the increase or diminution of temperature. According to the other opinion, heat is a subtile fluid that easily pervades the pores of all bodies, causing them to expand by means of its elasticity or otherwise. Each of these opinions is attended with its peculiar difficulties. The phenomena of heat may be accounted for by either of them, provided certain suppositions be allowed to each respectively; but the want of proof of the truth of such suppositions renders it very difficult, if not impossible, to decide as yet whether heat consists merely in motion or in some peculiar matter. The word *quantity*, applied to heat, will therefore denote either motion or matter, according to the opinion made use of, and may be used indefinitely without determining which.

80 Advantages of the doctrine that heat is caused by vibration.

"The chief advantage which the opinion that heat is caused by mere vibration possesses, is its great simplicity. It is highly probable, that all heated bodies have an intestine motion, or vibration of their parts; and it is certain that percussion, friction, and other methods of agitating the minute parts of bodies, will likewise increase their temperature. Why, then, it is demanded, should we multiply causes, by supposing the existence of an unknown fluid, when the mere vibration of parts which is known to obtain may be applied to explain the phenomena?"

81 Answer to Mr Nicholson's argument.

To this the reply is obvious, that the vibration of parts is an *effect*; for matter will not begin to move of itself: and if it is an effect, we must suppose a cause for it; which, though we should not call it a fluid, would be equally unknown and inexplicable with that whose existence is asserted by those who maintain that fire is a fluid *per se*.

82 Dr Cleghorn's proof that heat is occasioned by a fluid.

Dr Cleghorn, however, in the dissertation already quoted, asserts, that "heat is occasioned by a certain fluid, and not by motion alone, as some eminent writers have imagined: because, 1. Those who have adopted the hypothesis of motion could never even prove the existence of that motion for which they contended; and though it should be granted, the phenomena could not be explained by it. 2. If heat depended on motion, it would instantaneously pass through an elastic body; but we see that heat passes through bodies slowly like a fluid. 3. If heat depended on vibration, it ought to be communicated from a given vibration in proportion to the quantity of matter; which is found not to hold true in fact. On the other hand, there are numberless arguments in favour of the opinion that heat proceeds from elementary fire. 1. Mr Locke hath observed, that when we perceive a number of qualities always existing together, we may gather from thence that there really is some substance which produces these qualities. 2. The hypothesis of elementary fire is simple and agreeable to the phenomena. 3. From some experiments made by Sir Isaac Newton, it appears, that bodies acquire heat and cold *in vacuo*, until they become of the same temperature with the atmosphere; so that heat exists in the absence of all other matter, and is therefore a substance by itself."

83 Difficulties concerning the nature and properties of Fire.

But though these and other arguments seem clearly to establish the point that fire or heat is a distinct fluid, we are still involved in very great difficulties concerning its nature and properties. If it be supposed a fluid, it is impossible to assign any limits to its extent; and we must of necessity likewise suppose that it pervades the whole creation, and consequently constitutes an absolute plenum, contrary to a fundamental principle of the received system of natural philosophy. But if this is the case, it is vain to talk of its being absorbed, accumulated, collected, or attracted by different bodies, since it is already present in all points of space; and we can conceive of terrestrial bodies no otherwise than as sponges thrown into the ocean, each of which will be as full of fluid as it can hold. The different capacities will then be similar to the differences between bits of wood, sponge, porous stones, &c. for containing water; all of which depend entirely on the structure of the bodies themselves, and which, unless we could separate the water by pressure, or by evaporation, would be for ever unknown. Supposing it were impossible to collect this water in the manner we speak of, we could only judge of the quantity they contained by the degree to which they swelled by being immersed in it. It is easy to see, however, that such a method of judging would be very inadequate to the purpose, as substances might contain internal cavities or pores in which water could lodge without augmenting the external bulk. This would suggest another method of judging of the quantity, namely, the specific gravity;

vity; and we might reaſonably ſuppoſe, that ſubſtances of the greateſt ſpecific gravity would contain the ſmalleſt quantity of water, though ſtill we could by no means determine what quantity they did contain, unleſs we could lay hold of the element itſelf.

This ſeems to be very much the caſe with elementary fire, if we ſuppoſe it to be a fluid *per ſe*. We judge of its preſence by the degree of expanſion which one heated body communicates to another: but this is only ſimilar to the calculation of the quantity of moiſture a ſponge or any other body contains, by what it communicates to wood when it comes into contact with it; which never could be ſuppoſed to carry the leaſt pretenſions to accuracy, though we ſhould aſcertain it with all imaginable exactneſs. It is likewiſe probable, that the moſt denſe bodies contain the ſmalleſt quantity of fire, as they generally communicate leſs when heated to an equal temperature than thoſe which are more rare, though we are far from having any perfect knowledge in this reſpect.

84
**Difficulty ariſing from the ſuppoſition that heat diffuſes itſelf equally.**

But the greateſt difficulty of all will be, on the ſuppoſition that heat is a fluid, and an omnipreſent one (which it muſt be, or there would be ſome places where bodies could not be heated), to anſwer the queſtion, Why are not all bodies of an equal temperature, excepting only the differences ariſing from their ſpecific denſities, which render ſome capable of containing a greater quantity than others?—The difficulty will not be leſſened, though the omnipreſence of the fluid ſhould be given up, if we ſuppoſe, as is generally done, that heat has a tendency to diffuſe itſelf equably every way. If it has this tendency, what hinders it from doing ſo? Why doth not the heat from the burning regions of the torrid zone diffuſe itſelf equally all over the globe, and reduce the earth to one common temperature? This indeed might require time; but the experience of all ages has ſhown that there is not the leaſt advance towards an equality of temperature. The middle regions of the earth continue as hot, and the polar ones as cold, as we have any reaſon to believe they were at the creation of the world, or as we have any reaſon to believe they will be while the world remains. This indeed is one of the many inſtances of the impropriety of eſtabliſhing general laws from the trifling experiments we are capable of making, and which hold good only on the narrow ſcales on which we can make them, but are utterly inſufficient to ſolve the phenomena of the great ſyſtem of nature, and which can be ſolved only by obſerving other phenomena of the ſame ſyſtem undiſturbed by any manoeuvres of our own.

85
**Another from the ſeeming diſappearance of the heat.**

Again, ſuppoſing the objection already made could be got over, and ſatisfactory reaſons ſhould be given why an equilibrium of temperature in the earth and its atmoſphere ſhould never be obtained, it will by no means be eaſy to tell what becomes of the heat which is communicated to the earth at certain times of the year. This difficulty, or ſomething ſimilar, Dr Crawford ſeems to have had in view when treating of the effects of the evolution and abſorption of heat.

86
**Dr Crawford's ſolution.**

Thus, ſays he, "the Deity has guarded againſt ſudden viciſſitudes of heat and cold upon the ſurface of the earth.

"For if heat were not evolved by the proceſs of congelation, all the waters which were expoſed to the influence of the external air, when its temperature was reduced below 32°, would ſpeedily become ſolid; and, at the moment of congelation, the progreſs of cooling would be as rapid at it was before the air had arrived at its freezing point.

"This is manifeſt from what was formerly obſerved reſpecting the congelation of different fluids. It was ſhown, that if the velocities of the ſeparation of heat were equal, the times of the congelation would be in proportion to the quantities of heat which the fluids gave off from an internal ſource in the freezing proceſs. Whence it follows, that if no heat were evolved, the congelation ſhould be inſtantaneous.

"In the preſent ſtate of things, as ſoon as the atmoſphere is cooled below 32°, the waters begin to freeze, and at the ſame time to evolve heat; in conſequence of which, whatever may be the degree of cold in the external air, the freezing maſs remains at 32°, until the whole is congealed; and as the quantity of heat extricated in the freezing of water is conſiderable, the progreſs of congelation in large maſſes is very ſlow.—That the abſorption and extrication of heat in the melting and freezing of bodies has a tendency to retard the progreſs of theſe proceſſes, is remarked by Mr Wilkie in his eſſay on latent Heat.—The ſame doctrine is likewiſe taught by Dr Black in his lectures.

87
**Severity of the cold in the northern regions mitigated by the production of ice.**

"In the northern and ſouthern regions, therefore, upon the approach of winter, a quantity of elementary fire is extricated from the waters, proportional to the degree of cold that prevails in the atmoſphere. Thus the ſeverity of the froſt is mitigated, and its progreſs retarded; and it would ſeem that, during this retardation of the cooling proceſs, the various tribes of animals and vegetables which inhabit the circumpolar regions gradually acquire power of reſiſting its influence.

88
**Inundations prevented by the flowneſs with which congealed water melts.**

"On the contrary, if, in the melting of ice, a quantity of heat were not abſorbed, and rendered inſenſible, that ſubſtance, when it was expoſed to a medium warmer than 32°, would ſpeedily become fluid, and the proceſs of heating would be as rapid as if no alteration in its form had taken place. If things were thus conſtituted, the vaſt maſſes of ice and ſnow which are collected in the frigid zones would, upon the approach of ſummer, ſuddenly diſſolve, and great inundations would annually overflow the regions near to the poles.

"But by the operation of the law of the abſorption of heat, when the ice and ſnow upon the return of ſpring have arrived at 32°, they begin to melt, and at the ſame time to imbibe heat: during this proceſs, a large quantity of elementary fire becomes inſenſible; in conſequence of which the earth is ſlowly heated, and thoſe gradual changes are produced which are eſſential to the preſervation of the animal and vegetable kingdoms.

89
**Equal diſtribution of heat promoted by its abſorption and evolution.**

"We may remark, in the laſt place, that this law not only reſiſts ſudden changes of temperature, but that it likewiſe contributes to a more equal diſtribution of the principle of heat throughout the various parts of the earth, in different ſeaſons and climates. Thus the diurnal heats are moderated by the evaporation of the waters on the earth's ſurface, a portion of the fire derived from the ſun being abſorbed and extinguiſhed by the vapours at the moment of their aſcent. On the approach of night the vapours are again condenſed, and falling in the form of dew, communicate

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to the air and to the earth the fire which they had imbibed during the day.

"It was before shown, that, in the regions near to the poles, when the vernal and summer heats prevail, provision is made for tempering the severity of the winter cold, a quantity of elementary fire, upon the dissolution of the ice and snow, being absorbed by the waters, and deposited, as it were, in a great magazine for the purpose of mitigating the intensity of the cold when the frost returns.

90 Heat of the torrid zone thus mitigated.

"From the experiments of Hales, Halley, and Watson, it appears, that vast quantities of water are continually converted into vapour by the action of the solar rays upon the portion of the earth's surface which is exposed to the light; and by the celebrated discovery of Dr Black, it is proved, that, in the process of evaporation, much elementary fire is absorbed. It is manifest, that this cause will have a powerful influence in mitigating the intensity of the heat in the torrid zone, and in promoting a more equal diffusion of it through the earth. For a considerable portion of the heat, which is excited by the action of the solar rays upon the earth's surface within the tropics, is absorbed by the aqueous vapours, which being collected in the form of clouds, are spread like a canopy over the horizon, to defend the subjacent regions from the direct rays of the sun. A great quantity of elementary fire is thus rendered insensible in the torrid zone, and is carried by the dispersion of the vapours to the north and to the south, where it is gradually communicated to the earth when the vapours are condensed."

91 This solution totally insufficient to remove the difficulty.

That all this takes place, as the Doctor has advanced, cannot be denied; but, by allowing it, the difficulty is not removed in the smallest degree, as will appear from a due consideration of the phenomena which he himself has mentioned. He owns that the sun communicates fire to the earth: the question is, What becomes of it, seeing the emission is continual? In summer, the air, the earth, and the water, are heated to a certain degree. On the sun's declining southward, the air first loses its heat. Whither does it go? It does not ascend into the higher regions of the atmosphere, for these are constantly found colder than the parts below. It does not descend to the earth and water; for these give out the quantity they had absorbed, as Dr Crawford observes. Neither does it go laterally to the southern regions; for they are constantly very hot, and ought to impart their heat to those farther north, instead of receiving any from them. How comes it then, that the atmosphere seems perpetually to receive heat without ever being satiated? or if the heat cannot be found going off either upwards, downwards, or sideways, how are we to account for its disappearance?

92 Heat most probably the action of an omnipresent fluid.

This question seems to be altogether unanswerable on the supposition that heat is occasioned by the mere presence of a fluid; but if we suppose it to be only a particular mode of action of an omnipresent fluid, the whole difficulty vanishes at once.—On this supposition indeed the question will naturally arise, Whence does this motion proceed, or by what is its action in general

93 Fire seems destitute of gravity and *vis inertiae*.

determined? Dr Berkenhout, in enumerating the properties of matter, exempts fire from two of those usually ascribed to other material substances, viz gravitation and the *vis intertiæ*. "According to the philosophers (says he), matter cannot move without being either impelled or attracted. I doubt much whether this be true of fire, and whether, when uncombined, motion be not one of its essential properties.—Gravitation seems also to be no property of fire, which moves with equal facility in all directions, and may be accumulated in hard bodies to any degree without increasing their weight. Fire, being the cause of volatility, seems rather to be in constant counteraction to gravity."

But however essential we may suppose the motion of fire to be to it, there cannot be any self-existent mobility in its parts, otherwise it would soon be diffused equally throughout the universe, and the temperature of the whole reduced to an equilibrium. According to the present constitution of nature, we see that the distribution of heat is principally owing to the sun; and what we call its *quantity*, depends on the position of the sun with regard to terrestrial objects and the length of time they are exposed to his rays. Heat is not produced while the rays have a direct passage; and therefore fluids through which they pass easily, as air, are not heated by the rays of the sun. But when the rays are impeded in their course, and reflected in considerable quantity, a degree of heat takes place, which is always greater or less in proportion to the intensity of the rays.—In the reflecting substance, the heat will be comparatively greater in proportion to the quantity of rays which are absorbed or stopped in their course by it: but in any substance interposed betwixt the sun and the reflecting body, the heat is proportional to the quantity of rays reflected.—Now it is plain, that when the particles of light fall upon any opaque substance, and enter its pores, which by their extreme subtilty they are well calculated to do, they must make an attempt to pass directly through it in their natural course; but as this cannot be done, they will push laterally, and in all directions, in consequence of being perpetually urged by the impulse of the light coming from the sun: and thus an action will be propagated in all directions as radii from a centre towards a circumference, which when it takes place in that subtile fluid always produces what we call *heat*.

94 Distribution of heat owing to the sun.

95 How heat is produced by the sun's rays.

96 Proofs of the identity of fire, light, and electricity.

In completing the system of nature, we perceive three kinds of fluids of extreme subtilty, and very much resembling one another, viz. fire, light, and electricity. That it should be agreeable to vulgar conceptions to suppose these all to be ultimately the same, is not surprising; and on examining the evidence of their identity, it will certainly be found exceedingly strong. They all agree in the property of exciting the sensation of heat in certain circumstances, and in not doing so in others. Fire, we know, in the common acceptation of the word, always does so; but when it assumes the latent and invisible state, as in the formation of vapour, it lays aside this seemingly essential property, and the vapour is cold to the touch.—Light, when collected in a focus by a burning glass, i. e. when its rays converge towards a centre, and diverge or attempt to diverge from one, produces heat also: and so does the electric fluid; for it has been found that the aura converging from a very large conductor to the point of a needle, is capable of setting on fire a small cartridge of gunpowder, or a quantity of tinder surrouding it *. There seems also to be a connection betwixt fire

* See *Electricity*.

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fire and electricity in another way; for in proportion as heat is diminiſhed, or the bodies are cooled, electricity ſucceeds in its place. Thus all electric bodies by heat

97 Connection between fire or heat and electricity.

become conductors of electricity, and cannot be excited or made to ſhow any ſigns of containing that fluid; but as ſoon as the heat is removed, their electric property returns. Water is naturally a conducting ſubſtance: by being frozen its conducting power is leſſened, which ſhows an approach to electricity; and, by being cooled down to 20° below 0 of Fahrenheit, the ice actually becomes electric, and will emit ſparks by friction like glaſs*. The atmoſphere is a natural electric: but by a certain degree of heat it loſes this property, and becomes a conductor; nor is there any doubt that its electric properties are increaſed in proportion to the degree of cold imparted to it. In the winter time, therefore, we muſt conſider the frozen ſurface of the earth, the water, and the atmoſphere of the polar regions, as forming one electrical machine of enormous magnitude; for the natural cold of theſe countries is often ſufficient to cool the water to more than 20° below 0, and conſequently to render it an electric. That this is really the caſe, appears from the exceſſively bright aurora borealis and other electric appearances, far exceeding any thing obſerved in this country. In the ſummer time, however, no ſuch appearances are to be ſeen, nor any thing remarkable except an exceſſive heat from the long continuance of the ſun above the horizon. This quantity of heat then being ſucceeded by a proportionable quantity of electricity in winter, it is impoſſible to avoid concluding that the heat in ſummer becomes electric fluid in winter, which, going off through the celeſtial expanſe, returns again to the grand ſource of light and heat from which it originally came; thus making room for the ſucceeding quantities which are to enliven the earth during the following ſummer.

* See *Electricity.*

98 Exceſſive electricity of the polar regions in winter.

99 Heat in ſummer becomes electric fluid in winter.

Thus the diſappearance of heat in winter, and of electricity in ſummer, in theſe countries, will be very naturally and eaſily accounted for. It is true, that the phenomena of thunder and lightning ſhow the exiſtence of this fluid in vaſt quantities during the ſummer ſeaſon: but theſe phenomena are only partial, and though formidable to us, are trifling in compariſon with the vaſt quantities of electric matter diſcharged by the continual flaſhing of the aurora borealis, not to mention the fire-balls and meteors called *falling ſtars*, which are very often to be ſeen in the northern countries. In the ſummer-time, the air which is an electric, heated by the rays of the ſun, is excited or made to part with the fluid to the vapours contained in it; and it is the unequal or oppoſite electricity of the clouds to one another, or to the earth, which produces the lightning. But in winter, when the air, earth, and vapours, all become electric, they cannot diſcharge ſparks from one to another as before; but the whole, as one connected and vaſt electrified apparatus, diſcharges the matter almoſt in a continued ſtream for many months.

100 Why thunder and lightning take place in ſummer and not in winter.

101 Heat, light, cold, and electricity, the effects of one univerſal fluid

From a conſideration of theſe and other phenomena of nature, as well as of the beſt experiments which have hitherto been made, we muſt conſider fire in the abſtract as an omnipreſent fluid, of ſuch ſubtilty as to prevade all terreſtrial ſubſtances. When by any means it is made to diverge every way as from a centre, there it operates as heat; expands, rarefies, or burns, according to the intenſity of its action. Proceeding in ſtraight and parallel lines, or ſuch as diverge but little, it acts as light, and ſhows none of that power diſcoverable in the former caſe, though this is eaſily diſcoverable by making it converge into a focus. In a quieſcent ſtate, or where the motion is but little, it preſſes on the ſurfaces of bodies, contracts and diminiſhes them every way in bulk, forces out the expanding fluid within their pores, and then acts as cold. In this caſe alſo, being obliged to ſuſtain the vehement action of that part of the fluid which is in motion, it flies with violence to every place where the preſſure is leſſened, and produces all the phenomena of ELECTRICITY.

Nature of Heat.

## § 1. *Of the Nature of Heat.*

102 Particular ſolution of the phenomena of heat.

The manner in which the phenomena of heat may be ſolved, and its nature underſtood, will appear from the following propoſitions.

1. It is in all caſes obſerved, that when light proceeds in conſiderable quantity from a point, diverging as the radii of a circle from its centre, there a conſiderable degree of heat is found to exiſt, if an opaque body, having no great reflective power, is brought near that point.

2. This action of the light, therefore, may be accounted the ultimate cauſe of heat, without having recourſe to any farther ſuppoſitions; becauſe nothing elſe beſides this action is evident to our ſenſes.

3. If the point from which the rays are emitted is placed in a tranſparent medium, ſuch as air or water, that medium, without the preſence of an opaque body, will not be heated.

4. Another cauſe of heat, therefore, is the reſiſtance of the parts of that body on which the light falls, to the action mentioned in Prop. 1. Where this reſiſtance is weak, as in the caſes juſt mentioned, the heat is either nothing, or very little.

5. If a body capable of reflecting light very copiouſly is brought near the lucid point, it will not be heated*.

* See the article *Burning-Glaſs*.

6. A penetration of the light, therefore, into the ſubſtance of the body, and likewiſe a conſiderable degree of reſiſtance on the part of that body to the action of the light, are the requiſites to produce heat.

7. Thoſe bodies ought to conceive the greateſt degrees of heat into whoſe ſubſtance the light can beſt penetrate, *i. e.* which have the leaſt reflective power, and which moſt ſtrongly reſiſt its action; which is evidently the caſe with black and ſolid ſubſtances.

8. By heat all bodies are expanded in their dimenſions every way, and that in proportion to their bulk and the quantity of heat communicated to them.

9. This expanſion takes place not only by an addition of *ſenſible* heat, but likewiſe of that which is *latent*. Of this laſt we have a remarkable inſtance in the caſe of ſnow mixed with ſpirit of nitre. The ſpirit of nitre contains a certain quantity of latent heat, which cannot be ſeparated from it without effecting a change on the ſpirit itſelf; ſo that, if deprived of this heat, it would no longer be ſpirit of nitre.—Beſides this, it contains a quantity of ſenſible heat, of a great part of which it may be deprived, and yet retain its characteriſtic properties as nitrous acid. When it is poured upon ſnow, the latter is immediately melted by the action of the latent heat in the acid. The ſnow cannot



be

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be melted or converted into water, without imbibing a quantity of latent heat, which it receives immediately from the acid which melts it. But the acid cannot part with the heat without decomposition; to prevent which, its sensible heat occupies the place of that which has entered the snow and liquefied it. The mixture then becomes exceedingly cold, and the heat forces into it from all the bodies in the neighbourhood; so that, by the time it has recovered that quantity of sensible heat which was lost, or arrived at the temperature of the atmosphere around it, it will contain a considerably larger quantity of heat than it originally did, and is therefore observed to be expanded in bulk. Another instance of this expansive power of latent heat is in the case of steam, which always occupies a much larger space than the substance from which it was produced; and this whether its temperature is greater or less than the surrounding atmosphere.

10. The difference between latent and sensible heat, then, as far as we can conceive, is, that the expansive power of the former is directed only against the particles of which the body is composed; but that of the latter is directed also against other bodies. Neither doth there seem to be any difference at all between them farther than in quantity. If water, for instance, hath but a small quantity of heat, its parts are brought near each other, it contracts in bulk, and feels cold. Still, however, some part of the heat is detained among the aqueous particles, which prevents the fluid from congealing into a solid mass. But, by a continuation of the contracting power of the cold, the particles of water are at last brought so near each other that the internal or *latent* heat is forced out. By this discharge a quantity of air is also produced, the water is congealed, and the ice occupies a greater space than the water did; but then it is full of air-bubbles, which are evidently the cause of its expansion. The heat then becomes *sensible*, or, as it were, lies on the outside of the matter; and consequently is easily dissipated into the air, or communicated to other bodies. Another way in which the latent heat may be extricated is by a constant addition of sensible heat. In this case the body is first raised into vapour, which for some time carries off the redundant quantity of heat. But as the quantity of this heat is continually increased, the texture of the vapour itself is at last totally destroyed. It becomes too much expanded to contain the heat, which is therefore violently thrown out on all sides into the atmosphere, and the body is said to burn, or be on fire. See COMBUSTION, FLAME, and IGNITION.

11. Hence it follows, that those bodies which have the least share of latent heat, appear to have the greatest quantity of sensible heat; but this is only in appearance, for the great quantity they seem to contain is owing really to their inability to contain it. Thus, if we can suppose a substance capable of transmitting heat through it as fast as it received it; if such a substance was set over a fire, it would be as hot as the fire itself, and yet the moment it was taken off, it would be perfectly cool, on account of its incapacity to detain the heat among the particles of which it was composed.

12. The heat, therefore, in all bodies consists in a certain violent action of the elementary fire within them tending from a centre to a circumference, and thus making an effort to separate the particles of the body from each other, and thereby to change its form or mode of existence. When this change is effected, bodies are said to be dissipated in vapour, calcined, vitrified, or burnt, according to their different natures.

13. Inflammable bodies are such as are easily raised in vapours; that is, the fire easily penetrates their parts, and combines with them in such quantity, that, becoming exceedingly light, they are carried up by the atmosphere. Every succeeding addition of heat to the body increases also the quantity of latent heat in the vapour, till at last, being unable to resist its action, the heat breaks out all at once, the vapour is converted into flame, and is totally decomposed. See the article FLAME, and Prop. 10.

14. Uninflammable bodies are those which have their parts more firmly connected, or otherwise disposed in such a manner, that the particles of heat cannot easily combine with them or raise them into vapour.

15. Heat therefore being only a certain mode of the action of elementary fire, it follows, that the capacity of a body for containing it, is only a certain constitution of the body itself, or a disposition of its parts, which can allow the elementary fire contained in it to exert its expansive power upon them without being dissipated on other bodies. Those substances which allow the expansive power of the fire to operate on their own particles are said to contain a great deal of heat; but those which throw it away from themselves upon other bodies, though they feel very hot, yet philosophically speaking they contain very little heat.

16. What is called the *quantity* of heat contained in any substance, if we would speak with the strictest propriety, is only the apparent force of its action, either upon the parts of the body itself, or upon other bodies in its neighbourhood. The expansive force of the elementary fire contained in any body upon the parts of that body, is the *quantity of latent heat* contained in it; and the expansive force of the fire exerted upon other bodies which touch or come near it, is the *quantity of sensible heat* it contains.

17. If what we call *heat* consists only in a certain action of that fluid called *elementary fire*, namely, its expansion, or acting from a centre to a circumference, it follows, that if the same fluid act in a manner directly opposite to the former, or press upon the particles of a body as from a circumference to a centre, it will then produce effects directly opposite to those of heat, i. e. it will then be absolute *cold*, and produce all the effects already attributed to COLD. See that article.

18. If heat and cold then are only two different modifications of the same fluid, it follows, that if a hot body and a cold one are suddenly brought near each other, the heat of the one ought to drive before it a part of the cold contained in the other, *i. e.* the two portions of elementary fire acting in two opposite ways, ought in some measure to operate upon one another as any two different bodies would when driven against each other. When a hot and a cold body therefore are brought near each other, that part of the cold body farthest from the hot one ought to become colder than before, and that part of the hot body farthest from the cold one ought to become hotter than before.

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19. For the same reason, the greatest degree of cold in any body ought to be no obstacle, or at least very little, to its conceiving heat, when put in a proper situation. Cold air, cold fuel, &c. ought to become as intensely heated, and nearly as soon, as that which is hotter.

The two last propositions are of great importance. When the first of them is thoroughly established, it will confirm beyond a doubt, that cold is a *positive*, as well as heat; and that each of them has a separate and distinct power, of which the action of its antagonist is the only proper limit; *i. e.* that heat can only limit the power of cold, and *vice versa*. A strong confirmation of this proposition is the experiment related by M. Geoffroy; an account of which is given under the article COLD. Another, but not so well authenticated, is related under the article CONGELATION. —De Luc's observation also, mentioned by Dr Cleghorn, affords a pretty strong proof of it; for if the lower parts of the atmosphere are cooled by the passage of the sun's rays at some distance above, and it hath been already shown that they do not *attract* the heat from the lower parts, it follows, that they must *expel* part of the cold from the upper regions.—The other proposition, when fully established, will prove, that heat and cold are really convertible into one another; which indeed seems not improbable, as we see that fires will burn with the greatest fierceness during the time of intense frosts, when the coldest air is admitted to them; and even in those dismal regions of Siberia, when the intense cold of the atmosphere is sufficient to congeal quicksilver, it cannot be doubted that fires will burn as well as in this country; which could not happen if heat was a fluid *per se*, and capable of being carried off, or absolutely diminished in quantity, either in any part of the atmosphere itself, or in such terrestrial bodies as are used for fuel.

## § 2. *Of the general Effects of Heat.*

HAVING said thus much concerning the nature of heat in general, we come now to a particular explanation of its several effects, which indeed constitute the whole of the active part of chemistry.—These are,

I. *Expansion*, or increase of bulk in every direction. This is a necessary consequence of the endeavour which the fluid makes to escape in all directions, when made to converge into a focus. The degree of expansion is unequal in different bodies, but in the same body is always proportionable to the degree of heat applied. There are two different instruments in use for ascertaining the degrees of expansion; and as we have already shown, that the degree of heat can only be known by the expansion, these effects of heat upon the instrument are usually taken for the degrees of heat themselves. These instruments are called the THERMOMETER and PYROMETER. The former is composed of a glass tube, with a globe or rather oval tube at one end, and exactly closed at the other: it is most usually filled with mercury or spirit of wine; but mercury is generally preferred on account of its expansions being more equable than those of any other fluid. It has the disadvantage, however, of being subject to congelation; which is not the case with spirit of wine, when very highly rectified. Spirit-of-wine thermometers, therefore ought not to be entirely disused, but seem rather a necessary part of the chemical apparatus, as well as those made of mercury.

103 Instruments for measuring the expansions of bodies.

104 Wedgewood's improvement of the thermometer.

As no thermometer made with any fluid can measure either the degrees of heat about the point at which it boils, or the degree of cold below which it congeals, instruments have been contrived by which the expansion of solid bodies, though much less than what is occasioned by an equal degree of heat in a fluid, may become visible. These were usually called *Pyrometers*; but Mr Wedgewood has lately contrived a method of connecting the two together, in which the highest degree of heat, exceeding even that of a glass-house furnace, may be measured as accurately as the more moderate degrees by the common mercurial thermometer. See THERMOMETER.

105 Instances of bodies expanding by cold.

Expansion in some cases does not appear to be the effect of heat, of which we have two remarkable instances, viz. of iron, which always expands in cooling after it has been melted; and of water, which expands with prodigious force in the act of freezing. The power with which iron expands in the act of passing from a fluid to a solid state, has never been measured, nor indeed does it seem easy to do so; but that of freezing water has been accurately computed.

106 Prodigious force exerted by water in freezing.

This was done by the Florentine Academicians, who having filled an hollow brass ball of an inch diameter, with water, exposed it to a mixture of snow and salt, in order to congeal the water, and try whether its force was sufficient to burst the ball or not. The ball, being made very strong, resisted the expanding force of the water twice, even though a considerable part of its thickness had been pared off when it was perceived too strong at first. At the third time it burst; and by a calculation founded on the thickness of the globe and the tenacity of the metal, it was found that the expansive power of a spherule of water only one inch in diameter, was sufficient to overcome a resistance of more than 27,000 pounds, or 13 tons and an half.

107 Used as an argument for the existence of cold as a positive substance.

A power of expansion so prodigious, little less than double that of the most powerful steam-engines, and exerted in so small a body, seemingly by the force of cold, was thought to be a very powerful argument in favour of those who suppose cold to be a positive substance as well as heat; and indeed contributed not a little to embarrass the opposite party.

108 Explained by Dr Black's theory of latent heat.

Dr Black's discovery of latent heat, however, has now afforded a very easy and natural explication of this phenomenon. He has shown, that, in the act of congelation, water is not cooled more than it was before, but rather grows warmer: that as much heat is discharged, and passes from a latent to a sensible state, as, had it been applied to water in its fluid state, would have heated it to 135°.

109 The expansion produced by the extrication of air-bubbles.

In this process the expansion is occasioned by a great number of minute bubbles suddenly produced. These were formerly supposed to be formed of *cold* in the abstract; and to be so subtile, that, insinuating themselves into the substances of the fluid, they augmented its bulk, at the same time that, by impeding the motion of its particles upon each other, they changed it from a fluid to a solid. Dr Black, however, has demonstrated, that these are only air extricated during the congelation; and to the extrication of this air he very justly attributes the prodigious expansive force exerted by freezing water. The only

only question, therefore, which now remains is, By what means this air comes to be extricated, and to take up more room than it naturally does in the fluid? To this we can scarce give any other answer, than that part of the heat which is discharged from the freezing water combines with the air in its unelastic state, and, by restoring its elasticity, gives it that extraordinary force, as we see also in the case of air suddenly extricated in the explosion of gunpowder. Thus expansion, even in the case of freezing, is properly an effect of heat; and must therefore be considered as a phenomenon uniformly and certainly attending the action of heat, and in all cases to be ascribed to it.

110 This air extricated by part of the heat contained in the water.

111 Capacity of a body for containing heat, the same with the action of heat upon that body.

The only way in which the element or fluid of fire can be supposed to act, and the way in which we can have a rational idea of its being able to produce both heat and cold according to the diversity of its action, has been already explained so fully, that it is needless at present to enter into any further discussion of the subject. It will easily appear, that the *capacity* for containing heat is nothing different from the action of heat upon that body in expanding, and at last altering its form in such a manner, as either to be able to insinuate itself among the particles in much greater quantity than before, still retaining its internal action, though the external one becomes imperceptible; or scattering them in such a manner, that it breaks forth in great quantity in its peculiar appearances of fire and light; in the former case producing vapour or smoke, and in the latter flame, as shall afterwards be more fully explained. It must likewise appear, that to determine the quantity of heat in any body is altogether impossible: and with regard to the lowest degree of heat, or total expulsion of that fluid, so far from being able to determine what it is, the probability must be, that nature does not admit of any such thing; for if heat consists in the expansive action of a certain fluid, and cold in its opposite or contractile action, there is very little reason to suppose that the constitution of nature will allow any one of these actions intirely to cease, as it does not appear by what means it could again be renewed. Cold, as we have already seen, always tends to produce electricity; and the connexion betwixt that and fire is so strong, that we cannot suppose the former to be carried to any great extreme without producing the latter. Whatever we may therefore suppose concerning the capacities of different bodies for containing heat, or concerning the point of total privation of heat, must be altogether void of foundation. A rule, however, has been given by Mr Kirwan for finding the point of total privation, which, together with its demonstration, we shall subjoin; and as it is necessary for the better understanding of this, to call to remembrance what has been said concerning the difference between the temperatures and specific heats of bodies, we shall insert an epitome of the doctrine from Mr Nicholson.

112 Impossibility of determining the quantity of heat any body contains.

113 Mr Nicholson's account of the capacities of bodies for containing heat, &c.

"If two equal bodies of different kinds and temperatures be brought into contact, the common temperature, will seldom, if ever, be the mean betwixt the two original temperatures; that is to say, the surplus of heat in the hotter body will be unequally divided between them, and the proportions of this surplus retained by each body will express their respective dispositions, affinities, or capacities for heat.—If, therefore, a given substance, as for example fluid water, be taken as the standard of comparison, and its capacity for heat be called one, or unity, the respective capacities of their bodies may be determined by experiment, and expressed in numbers in the same manner as specific gravities usually are. And because it is established as well from reason as experiment, that the same capacity for heat obtains in all temperatures of a given body, so long as its state of solidity, fluidity, or vapour is not changed, it will follow, that the whole quantities of heat in equal bodies of a given temperature will be as those capacities. And as the respective quantities of matter, in bodies of equal volume, give the proportions of their specific gravities, so the respective quantities of heat in bodies of equal weight and temperature give the proportions of their specific heats.

"A greater capacity for heat, or greater specific heat, in a given body, answers the same purpose with respect to temperature as an increase of the mass; or the quantity of heat required to be added or subducted, in order to bring a body to a given temperature, will be as its capacity or specific heat.

"The capacities not only differ in various bodies, but also in the same body, according as it is either in a solid, fluid, or vaporous state. All the experiments hitherto made conspire to show, that the capacity, and consequently the specific heat, is greatest in the vaporous, less in the fluid, and least in the solid state.

"The quantity of heat that constitutes the difference between the several states, may be found in degrees of the thermometer. Thus if equal quantities of water at 162° and ice at 32° of temperature be mixed, the ice melts, and the common temperature becomes 32°; or otherwise, if equal quantities of frozen or fluid water, both at 32°, be placed in a like situation to acquire heat from a fire, the water will become heated to 162°, while the ice melts without acquiring any increase of temperature. In either case the ice acquires 130° of heat, which produces no other effect than rendering it fluid. Fluid water, therefore, contains not only as much more heat than ice, as is indicated by the thermometer, but also 130°, that is in some manner or other employed in giving it fluidity. And as fluid water cannot become ice without parting with 130° of heat besides what it had above 32° in its temperature; so also steam cannot become condensed into water without imparting much more heat to the matters it is cooled by, than water at the same temperature would have done.

"The heat employed in maintaining the fluid or vaporous form of a body, has been called latent heat, because it does not affect the thermometer.

114 Mr Kirwan's theorem for finding the point of total privation of heat.

"From the consideration of the specific heats of the same body in the two states of fluidity and solidity, and the difference between those specific heats, is deduced a method of finding the number of degrees which denote the temperature of any body immediately after congelation, reckoned from the natural zero, or absolute privation of heat. The rule is; multiply the degrees of heat required to reduce any solid to a fluid state, by the number expressing the specific heat of the fluid: divide this product by the difference between the numbers expressing the specific heat of the body in each state: the quotient will be the number of

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of degrees of temperature, reckoned from an absolute privation of heat.

"This theorem is Mr Kirwan's, and may be proved thus. Let $s$ represent the required temperature of the body just congealed, $l =$ the number of degrees that express the heat required to reduce it to fluidity, $n =$ the specific heat of the solid, and $m =$ the specific heat of the fluid. Then $s+l : s :: m : n$. Whence $s = \frac{ln}{m-n} =$ the temperature from the natural zero in thermometrical degrees of the fluid. But because the actual fall of the thermometer is to be produced by cooling the solid, we must pay attention to its capacity. The quantity of heat required to produce a given change of temperature in a body is as its capacity; and consequently the changes of temperature, when the quantity of heat is given, will be inversely as the capacities: therefore, $n : m :: \frac{ln}{m-n} : \frac{ln}{m-n} = s$. which is the rule abovementioned.

"If the data $l$, $m$, and $n$, be accurately obtained by experiment, in any one instance, and the difference between the zero of Fahrenheit's scale and the natural zero he thence found in degrees of that scale, this difference will serve to reduce all temperatures to the numeration which commences at the natural $o$. So that $s$ being known in all cases, if any two of the quantities $l$, $m$, or $n$, be given in any body, the other may be likewise had. For $l = \frac{sm-sn}{m}$; and $m = \frac{sn}{s-l}$ and $n = \frac{sm-lm}{s}$.

"To give an example of this curious rule, let it be required to determine how many degrees of refrigeration would absolutely deprive ice of all its heat? The degrees of heat necessary to melt ice are 130; and the specific heats of ice and water are as 9 to 10. The number 130 multiplied by 10, produces 1300, and divided by the difference between 9 and 10 quotes 1300: therefore if ice were cooled 1300 degrees below 32°, or to—1268 of Fahrenheit's scale, it would retain no more heat."

II. *Fluidity* is another effect of heat, and is capable of taking place in all bodies hitherto known, when the fire is carried to a certain pitch. Theories have been invented, by which fluidity was ascribed to the smoothness and round figure of the particles whereof bodies were composed, and solidity to an angular or irregular figure. It has also been ascribed to a stronger degree of attraction between the parts of solids than of fluids. Dr Black, however, has shown, that in the case of melting ice, we are certainly to ascribe the acquired fluidity of the water to the absorption of heat. This was determined by a decisive experiment, in which he exposed a Florence-flask full of water to the atmosphere in a warm room, when he found that the heat in the air evidently left it, to flow into the ice in the bottle, and reduced it to fluidity. The air thus deprived of its heat, he felt sensibly descending like a cold blast from the bottle, and continuing to do so as long as any of the ice remained unthawed; yet after it was all melted, the temperature of the fluid was no more than 32°. Different degrees of heat are requisite for converting different solids into fluids, for which see the *Table of Degrees of Heat*.

115 Fluidity to be ascribed to the absorption of heat.

This theory receives an additional confirmation from the quantity of heat which is always known to be produced by the conversion of a fluid into a solid. And that this is really the case appears, 1. From what happens in the congelation of waters, it appears that ice is formed very slowly, and with several circumstances which support the theory.—Thus, if we suppose equal quantities of water to the air, which is perhaps 10 below frost, and add to one of these a small quantity of salt or spirit of wine, and observe the cooling of each, we shall find them both grow gradually colder, until they arrive at the temperature of frost: after which the water containing the salt will continue to grow colder, until it has arrived at the temperature of the air, at the same time that only a small quantity of the other water is converted into ice. Yet were the common opinion just, it ought all to have been congealed by this time; instead of which, it is scarce grown a degree colder during the whole time. Its remaining at the same temperature for so long a time, shows that it has been communicating heat to the atmosphere; for it is impossible that any body can remain in contact with another that is colder, without communicating heat to it. Whence then comes this heat? There must be some source adding to the sensible heat of the water, so as to keep its temperature to the freezing point: and this source of heat must be very considerable; for it will continue to act for a very long time before the water is changed into ice; during all which time, even to the last drop, the water is not a degree colder than 32° of Fahrenheit's thermometer. This, therefore, is the *latent heat* of the water, which had formerly entered into it during its transition from ice to a fluid state.

116 Sensible heat produced by the conversion of a fluid into a solid.

A still stronger argument is derived from the following experiment; which evinces that the fluidity of water really depends upon its latent heat, and that the sensible heat is only a mean or condition to its containing the latent heat. This experiment consists in exposing water contained in a covered beer-glass to the air of a cold frosty night; and when the atmosphere is at the temperature of perhaps 10° or 12° below frost, the water will acquire that temperature without freezing: so that the fluidity of the water does not altogether depend on the quantity of sensible heat contained in it. The congelation, however, may be brought on by touching it with a bit of ice, with the extremity of a wire, by a shock upon the board, or otherwise disturbing it; and we then find the temperature suddenly raised up to 32°. This shows plainly, that the water has a disposition to retain the quantity of latent heat, upon which its fluidity must immediately and necessarily depend; and it retains it with a certain degree of force, so as to keep the water fluid in a temperature below that in which it usually parts with the latent heat and congeals. By disturbing it, however, we instantly bring on the congelation, which cannot take place without an extrication of the latent heat; which then, being changed into the ordinary or moveable heat, raises the thermometer as usual. The quantity of heat discharged from the first small portion of ice formed in the water is sufficient to prevent any more latent heat from separating, and consequently from any more ice being produced till more of the sensible heat is abstracted.

117 Argument in support of the theory from water remaining fluid tho' cooled below 32°.

This doctrine extends not only to such bodies as are actually converted from a solid to a fluid, or from

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a fluid to a solid state, but to such as are in a kind of middle state betwixt solidity and fluidity; for every degree of softness depends on a certain degree of heat contained in the body. Thus, for instance, melted wax, allowed to cool slowly, soon becomes opaque and consistent; but it must be colder still before it attains its utmost degree of hardness. There is therefore a certain degree of heat below which every body is solid, and above which every one is fluid; the former being called the *congealing*, and the latter the *melting*, point of bodies.

118 Heat the cause of the softness of bodies approaching to fluidity.

119 Absorption of heat the universal cause of fluidity.

By making experiments upon different substances, the Doctor was convinced that latent heat is the universal cause of fluidity; and the doctrine holds good in all the experiments that have hitherto been made upon spermaceti, bees-wax, and some of the metals. If they are melted, allowed to cool slowly, and a thermometer be immersed into them, we find, that as long as they continue fluid, their sensible heat diminishes very fast; but as soon as they begin to grow solid, the sensible heat continues greater than that of the air to which they are exposed; and during all this time it is communicating heat to the air, without having its sensible heat diminished; for the latent heat within the fluid gradually receives a sensible form, and keeps up the temperature, proving a source of sensible heat, which is communicated to the neighbouring bodies as well as the surrounding air. The softness and ductility of bodies depend on this also.

120 Vapour formed by the absorption of latent heat.

III. *Evaporation*. A third effect of the action of heat is that of converting bodies into vapour, by which they are rendered specifically lighter than the surrounding atmosphere, and enabled to rise in it. To account for this, many theories have been invented; but that of Dr Black, who accounts for it, as well as fluidity from the absorption of latent heat, is now universally received. The circumstances by which he proves and illustrates his doctrine are the following:

1. When we attend to the phenomena of boiling water, in a tea kettle for instance, it may, when first put upon the fire, be about the temperature of 48° or 50°. In a quarter of an hour it will become heated to 212°. It then begins to boil, and has gained 162° of vapour in that time. Now, if the conversion of it into vapour depended on the quantity of sensible heat introduced, we may ask how long it will be necessary to raise it all in vapour? Surely another quarter of an hour should be sufficient; but this is far from being the case. Dr Black made some experiments upon this subject in conjunction with another gentleman. Having the opportunity of what is called a kitchen-table or a thick plate of cast iron, one end of which was made sensibly red-hot, they set upon this some iron vessels with circular flat bottoms, of about four inches diameter, and which contained a quantity of water. The temperature of the water was noted, as also when it began to boil; and when the whole of it was boiled away, it was found, that when set on the table its temperature had been 54°; in four minutes it began to boil, and in that space of time received 158° degrees of heat. Had the evaporation, therefore, depended merely on the quantity of sensible heat introduced, it ought to have been dissipated entirely in a single minute more. It was, however, 18 minutes in dissipating; and therefore had received 807 degrees of heat before it was all evaporated. All this time, therefore, while the water continued to boil, it was receiving a great quantity of heat, which must have been flowing equally fast out of it; for the vessel was no hotter, and the iron plate continued equally hot, the whole time. The vessels were of different shapes, some of them cylindrical, some conical, others widening upwards; one of the designs of the experiment being to show how far the evaporation was retarded by the particular form of the vessels. By suspending a thermometer in the mouth of one of the evaporating vessels, the heat of the steam was found to be exactly 212°; so that as the great quantity of heat absorbed was found neither to have remained in the water, nor to have been carried away by the steam in a sensible manner, we have nothing left to suppose, but that it flew off as one of the component parts of the steam in a latent state.

121 Experiments by Dr Black on the conversion of water into vapour.

2. In an experiment to show the fixedness of the boiling point of water, Dr Black inclosed some of that fluid in a strong vial having a thermometer in it, and stopped close with a cork. By the application of heat he hoped now to be able to raise the thermometer some degrees above the boiling point, which would be the natural consequence of the confinement of the steam. When this was done, he pulled out the cork, and supposed that the water would now all fly out in vapour: but in this he was totally disappointed; a sudden and very tumultuous boiling ensued, which threw out some of the water; but though some quantity of steam likewise issued, the quantity of water was not considerably diminished. The vial had been heated to 20° above the boiling point, but almost instantly cooled down to 212°, when the cork was taken out.

3. Mr Watt, in making some experiments on the force of steam, had occasion to use Papin's digester, with a pipe proceeding from its side; the orifice of which was shut with a valve pressed down by one end of a lever. Thus he heated steam to 400° of Fahrenheit; after which, having suddenly struck off the lever, a quantity of steam flew out with considerable noise, and with such violence as to make an impression on the ceiling of the room; but this noise gradually diminished, and after ten minutes it ceased entirely; and upon opening the machine, he found the greatest part of the water still remaining.

122 Boiling point of water *in vacuo* determined by Mr Boyle.

4. The change of sensible into latent heat in the formation of vapour, appears still more evident in the boiling of water *in vacuo*. Mr Boyle took a quantity of water which had been previously boiled to purge it of its air, and put it whilst hot under the receiver of an air-pump. In consequence of this it began again to boil, and continued boiling till it was only lukewarm, and it soon arrived at this temperature; so that in this case also the heat had disappeared during the conversion of the fluid into vapour. Others have repeated the experiment, as Boerhaave, Muschenbroek; and Robinson, who lectures on chemistry in Glasgow, says that the heat diminishes very fast till it comes to 90° or 95°, which seems to be the boiling point of water *in vacuo*. As a considerable part of the heat thus disappears, and is to be discovered neither in the water nor in the vapour, we must conclude that it enters the latter as part of its composition.

123 And by Mr Robinson of Glasgow.

5. Thus also we may understand some curious experiments made by Dr Cullen upon ether and other volatile

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latile fluids. He employed ſome perſons to make experiments upon the cold produced by evaporation; and willing to repeat them himſelf *in vacuo*, he put ſome of the moſt volatile liquors under the receiver of an air-pump. One of theſe was ether. It was contained in a glaſs, in which there was alſo placed ſome water. When the air was extracted, the ether began to boil, and to be converted into vapour, till it became ſo very cold that it froze the water contained in the veſſel, though the temperature of the room was about 50°. Here therefore there was a quantity of heat which diſappeared all of a ſudden; which it is plain could not be owing to its having any communication with that of the atmoſphere or other cold bodies, as they could not render it colder than they were themſelves. Ether therefore is to be conſidered as a fluid ſo volatile, that were it not for the preſſure of the atmoſphere it would be perpetually in the ſtate of vapour.

124 Dr Cullen's experiments on cold produced by evaporation.

125 Heat expelled in great quantity by the condenſation of vapour.

6. That this heat which enters into the vapour is not deſtroyed, but remains in a latent ſtate, is eaſily proved; for we find that a great quantity of heat is expelled from vapour when it is condenſed again to form the body it compoſed originally. This is eaſily aſcertained by obſerving the quantity of heat communicated to the water in the refrigeratory of a ſtill by any given quantity of liquid which comes over. Thus, if the refrigeratory contain 100 pounds of water, and the diſtillation be continued till only one pound has come over, ſuppoſing the water in the refrigeratory to have received 8° of heat; it is plain, that if the whole of the quantity thus received could be thrown into one pound of water, the latter would be heated to 800°; which is ſufficient to make an equal ſpace of iron red-hot. But that this quantity of heat is received by the water in the refrigeratory has appeared from ſeveral experiments, which ſhow that water, by being converted into vapour, abſorbs between 800° and 900° of heat.

126 Mr Watt's experiments on the evaporation of fluids *in vacuo*.

On this principle we may explain ſome curious experiments made by Mr Watt with regard to the evaporation of fluids *in vacuo*. That gentleman had formed a deſign of converting water into ſteam with leſs expence of fuel, which he imagined might be done by removing the preſſure of the air from the water, which he thought would thus require a much ſmaller quantity of fuel to convert it into vapour. Dr Black, however, perceiving that only the ſmall quantity of ſenſible heat the ſteam poſſeſſed could thus be carried off, informed him beforehand that his project would not be found attended with the advantages he imagined. The experiment, however, was made in the following manner: A ſtill was procured of tinned iron, the body of which reſembled that of a retort, with a veſſel ſerving as a condenſer; the whole apparatus being cloſe, excepting a little hole in the extremity of the condenſing veſſel. He firſt exhauſted this veſſel of air by holding the condenſer over the retort, in which ſome boiling water was contained, until it was entirely converted into ſteam. He then ſuddenly ſtopped the little hole, and removed the veſſels from the fire; when, after they were cooled, there was a pretty perfect vacuum formed by the condenſation of the ſteam. The retort was then put on the fire, and turned ſo that the pipe and condenſing veſſel ſhould hang downward; and plunging them into cold water, heat was applied to the ſtill till the water boiled, as could be known by the noiſe. It was kept boiling, till a quantity of ſteam was puſhed over and condenſed with a very gentle heat, the ſtill feeling little warmer than his hand. After a certain quantity had been diſtilled, the apparatus was removed, and he had noted the heat of the water in the refrigeratory; but though the ſteam all along came over with ſo gentle a heat, he found the quantity communicated to the water in the refrigeratory to be ſurpriſingly great, not leſs than 1000°; ſo that it would have been more than ſufficient to heat the quantity of liquor which came over red-hot.

127 Ignition a conſtant and ſteady effect of heat.

128 All ignited bodies equally hot.

IV. *Ignition*, or the cauſing bodies to ſhine or emit light in the dark. This may be conſidered as a ſpecies of inflammation, and ſhall therefore be explained under that head: here we ſhall only obſerve, that ignition is a more ſteady and conſtant effect of heat than either the production of fluidity or vapour; and appears not only to be the ſame degree with regard to any particular body, but the ſame with regard to all kinds of matter. Dr Martin imagines, that a red-hot piece of iron is hotter than a red-hot piece of ſtone; but if you put into a crucible an hundred different kinds of matter, as metals, glaſs, &c. that are capable of bearing a red heat, they will all begin to appear luminous about the ſame time, and their brightneſs will increaſe equally as their heat increaſes. But it is difficult to know at what point this begins, as we have no way of aſcertaining the beginning or loweſt degree of ignition but by the effect it produces on our ſight, and we cannot be ſure that we perceive the loweſt degree of light; for we know that other animals ſee objects with ſuch light as appears perfect darkneſs to us. Sir Iſaac Newton's method of determining this has been already mentioned.

129 Metals may become vaſtly hotter after they are brought into fuſion.

Dr Boerhaave entertained a notion, that ſome metals, after being once brought into a ſtate of fuſion, could be made no hotter; and propoſes the poſſibility of this as a queſtion, "Whether the heat of metals can be increaſed after they are melted?" There is not, however, the leaſt doubt but that their heat may be vaſtly increaſed after they are melted; and we know certainly that ſuch as are of eaſy fuſion may be heated to a vaſtly greater degree after being melted; and why may not thoſe requiring ſtronger heats be the ſame? We are ſure that this is the caſe with ſilver, which, after being melted, may be brought to ſuch a heat as to become too dazzling for the eye to bear it. If Boerhaave's opinion were juſt, it would be impoſſible to caſt any metal into moulds, becauſe it muſt loſe a little heat in being removed from the fire and in entering the mould; nor would they receive a proper impreſſion if they did not contain a greater quantity of heat than was neceſſary for their fuſion.

130 Ignition an univerſal effect of fire.

131 Water may be made ſufficiently hot to melt lead.

Ignition appears to be univerſal; and all bodies capable of ſupporting it without being converted into an elaſtic vapour that cannot be confined, are affected the ſame way. Water, which in its ordinary ſtate ſeems very little capable of enduring this heat, may be confined in ſtrong veſſels ſo as to become capable of melting lead, which is more than half way betwixt a red heat and that of boiling water. Experiments with the eolipile ſhow alſo that it can be made red-hot; for when the ſteam paſſes through burning fuel, it can-

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not miss of being made red hot. Dr Black has also frequently seen the vapour of water heated by throwing it into the ash-pit of a furnace, so as to produce a very large and transparent flame in rising up through the vent. There is reason therefore to conclude, that ignition is one of the more general effects of heat, only that some bodies are incapable of it until they be reduced to a state of vapour.

132 Difference betwixt ignition and inflammation.

V. The last of the effects of heat here to be taken notice of is *inflammation*. It differs from ignition in this, that the bodies subject to the latter gradually grow cooler as soon as they are taken out of the fire, without undergoing any considerable change; while those subject to inflammation become continually hotter and hotter, communicating a vast quantity of heat to others, and undergoing a kind of decomposition themselves, insomuch, that by this means they have beeen thought to be reduced to their constituent principles or elements.

133 Inflammation decompounds but does not destroy bodies.

Some substances indeed seem to be an exception to this, as in the open air they burn totally away, without leaving any residuum or producing any soot. These are spirit of wine, sulphur, and especially inflammable air; which last, by a proper mixture with dephlogisticated air, may be so totally consumed, that scarce a fiftieth part of the two will remain. On a careful examination of these substances, however, we find that there is by no means a total consumption, or indeed, properly speaking, any consumption at all, at least if we measure the quantity of matter by the weight of the substance employed.

134 Spirit of wine yields a great quantity of water by being burned.

Thus, if we are at pains to collect the vapour of burning spirit of wine, we will find, that an aqueous dew is collected, which sometimes equals the spirit of wine itself in weight. With regard to sulphur, the case is still more evident; for the vapour of this, when collected, not only equals but greatly exceeds the weight of the sulphur employed; and on burning dephlogisticated and inflammable air together, as much water is found to be produced as nearly equals the weight of both airs.

135 Water produced by the deflagration of dephlogisticated and inflammable air.

In like manner, when we collect the ashes, water, soot, and oil, procured by burning any of the common inflammable substances, we will find, that they in general exceed the weight of the matter employed. The great waste of bodies by fire, therefore, is owing to the dissipation of the volatile principles they contain, which are carried off and rendered invisible by being mixed with the atmosphere.

136 Of the existence of phlogiston.

The process of inflammation has long been explained from the presence of a substance called *Phlogiston* in those bodies which are subject to it, and which is supposed to be the same in all bodies belonging to this class; the differences between them arising from the principles with which it is combined.

137 Denied by M. Lavoisier.

This doctrine, which was first introduced by Stahl, has given occasion to such various and discordant theories, that the existence of phlogiston has been lately denied altogether by M. Lavoisier, who brought in a new method of solving the phenomena of fire, heat, and ignition, without any assistance from this principle.

138 Arguments against it drawn from the increased weight of metals by calcination.

The foundation of M. Lavoisier's doctrine is the increase of weight in metals by calcination. This increase he finds to be precisely, or very nearly so, proportionable to the decrease of weight in the air in which they are calcined. His theory, therefore, is, that in the act of calcination, the pure part of the air, which he calls the *acidifying* or *oxygenous* principle, unites with the metal, and converts it into a calx.

139 His theory of inflammation.

In like manner, in substances truly inflammable, the heat and flame are supposed to proceed from the union of the pure air, or the oxygenous principle, with the substance, and converting it into those principles which are found to remain after inflammation. Thus the increased weight of the substance is easily accounted for; while the inflammation, in his opinion, is nothing more than a combination of the inflammable body itself with pure air, which has an attraction for it: and in confirmation of that it is urged, that when combustion is performed in empyreal or dephlogisticated air, the whole of the latter is absorbed; but in common atmospherical air only one-fourth, being the quantity of pure air contained in it.

140 Arguments for the non-existence of phlogiston, from the reduction of the calces of perfect metals without addition.

Other arguments in favour of this opinion are, that the calces of the perfect metals may be reduced without addition by the mere emission of the oxygenous principle, (dephlogisticated air); by an union with which they assume the form of a calx. Thus he evades a very strong argument used by the opposite party; who adduced, as a proof of the existence of phlogiston, the use of charcoal in the reduction of metals to their proper form.

141 Dispute betwixt Lavoisier and Priestley.

A dispute indeed took place betwixt M. Lavoisier and Dr Priestley concerning the reduction of the whole of a mercurial calx formed by an union with the nitrous acid without addition; the Doctor maintaining that the whole could not be reduced by mere heat, but that a very perceptible quantity was always lost: but on a thorough examination of the subject, the truth seemed rather to lie on M. Lavoisier's side. See AEROLOGY.

142 Dr Lubbock's theory.

Another theory, somewhat similar to that of Lavoisier's, has been published by Dr Lubbock, in an Inaugural Dissertation in 1784. In this he supposes two kinds of matter to exist in the universe; one he calls the *principium proprium*, the other the *principium sorbile*; and it is this latter, which, according to our author, is the principle of mutability, or which by being united in various proportions with the other, forms bodies of all the different kinds we see in nature. It is this principle, therefore, which he supposes to be absorbed in the calcination of metals, and not empyreal air, as M. Lavoisier supposes; and he contends, that this same principle extends throughout the whole system of nature, even to the utmost celestial bounds.

143 Disputes concerning phlogiston now entirely decided.

It would exceed the limits of this treatise to give an account of the various theories which have been invented, and the arguments used for and against them; nor indeed is there any occasion for doing so, as late experiments have reduced the dispute into a much narrower compass than before, and furnished the most decisive arguments in favour of the existence of phlogiston.

144 Objections against the existence of phlogiston from its invisibility and supposed want of gravity.

The greatest objection to the belief of this principle was, that it could neither be seen nor felt by our senses directly, nor discover itself indirectly by the weight it communicated to the bodies with which it was united; on the contrary, the latter always became lighter in proportion to the quantity they contained: so that it was imagined, instead of being possessed of any specific gravity of its own, to be a principle of positive levity, such as that of heat or light may be reasonably supposed. This objection, however, is now intirely removed; and phlogiston in the abstract is found

found to be no ſubtile principle capable of eluding our reſearches, but one very common, and eaſily met with, being no other than common charcoal. In the laſt

145 Common charcoal and phlogiſton the ſame.

edition of this work, under the article PHLOGISTON, it was ſhown, that inflammable air, deprived of its elaſticity, and combined with metallic ſubſtances, is really their phlogiſton; and that in the inflammable bodies commonly uſed, what we call their phlogiſton, is really their oil; and that which exiſts in charcoal, and cannot be driven off by diſtillation, is part of the empyreumatic or burnt oil of the ſubject which adheres ſo obſtinately. A ſimilar doctrine ſoon after appeared in the Philoſophical Tranſactions for 1782, and the identity of phlogiſton and inflammable air was clearly pro-

146 Deciſive proofs of this identity given by Dr Prieſtley.

ved by Mr Kirwan. Still, however, it was inſiſted by the French philoſophers and others, that no *facts* had been adduced againſt M. Lavoiſier, nor any deciſive proofs appeared of the exiſtence of phlogiſton as a ſubſtance *per ſe*. Facts of this kind, however, have now been diſcovered by Dr Prieſtley, and are related under the articles AEROLOGY, CHARCOAL, PHLOGISTON, &c. It is ſufficient at preſent to mention, that he

147 Spirit of wine and metals convertible into charcoal.

has been able to convert the pureſt ſpirit of wine, and one of the hardeſt metals, viz. copper, as well as ſeveral others, into a ſubſtance entirely reſembling charcoal; that by means of the heat of a burning glaſs in vacuo, he has diſſipated this metallic char-

148 Charcoal entirely diſſipated by heat into inflammable air.

coal, as well as the common kind, *entirely* into inflammable air, with the aſſiſtance only of a little water, which ſeems neceſſary to make it aſſume the aerial form, and perhaps is the true ſolvent of it; and by a combination with the element of heat, with the aid of the charcoal, is enabled to reſiſt condenſation in the common way.* This inflammable air, when abſorbed by metallic calces, again reduces them to their metallic

* See *Elaſtic Vapour*.

149 Metallic calces reduced by inflammable air.

form: ſo that here is one fact by which the phlogiſton not only appears to our ſenſes, but we are able to aſcertain its quantity with the utmoſt preciſion. Nor can it here be any objection, that the reduced metal is lighter than the calx; for this only proves that the metallic earth, while a calx, is united to a heavy ingre-

150 Why metals are lighter in their metallic than in their calcined ſtate.

dient (the baſis of dephlogiſticated air), and in the latter to a light one, viz. charcoal, the baſis of inflammable air.

Another caſe in which the exiſtence of phlogiſton is made equally evident to our ſenſes, and where no ſuch objection can occur, is related under the article AEROLOGY, n° 112. It is there ſhown, that "by the

151 Dephlogiſticated air converted into aerial acid by charcoal.

loſs of one grain of charcoal of copper (formed by the union of ſpirit of wine with the metal), and which like common charcoal was conſumed without having any reſiduum, he reduced four ounce-meaſures of dephlogiſticated air till only one-ninth remained unabſorbed by water; and, again, with the loſs of one grain and a half of charcoal, ſix and an half meaſures of dephlogiſticated air were reduced till five and an half meaſures were pure fixed air."—Here, then, is an abſolute and undeniable evidence, that fixed air is compoſed of dephlogiſticated air, and charcoal or phlogiſton, and elementary fire. There were no other ingredients preſent, and the charcoal muſt either have been annihilated or diſpoſed of in the manner juſt mentioned: but the ſuperior weight of the fixed air evidently ſhows that ſome ingredient had been added to the dephlogiſticated air; and which increaſe was more than we can ſuppoſe to ariſe from the condenſation of the dephlogiſticated air during the operation, for this ſometimes amounted to no more than one-thirtieth part.

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152 Objections drawn from the total combuſtion of dephlogiſticated air in ſome caſes.

The ſtrongeſt objection which can be made againſt the doctrine of phlogiſton may be drawn from the total conſumption of pure air in certain caſes of combuſtion, for inſtance, in that of phoſphorus, inflammable air, and iron. It muſt be obſerved, however, that in no caſe whatever is the air totally conſumed; and in that of inflammable air water is produced by the union of the baſis of the latter, that is charcoal, with the baſis of dephlogiſticated air, the oxygenous principle of M. Lavoiſier, and which appears to be one of the component parts of WATER. In the caſe of phoſphorus, the latter is converted into an acid; and in all probability a quantity of water is alſo pro-

153 Little phlogiſton expelled from iron by being burnt in dephlogiſticated air.

duced, by which part of it is converted into cryſtalline flowers. The caſe of the iron, therefore, alone remains to be conſidered. Dr Prieſtley's experiments on this ſubject are related at length under the article AEROLOGY, n° 67 *et ſeq*. In them the iron burnt briſkly in dephlogiſticated air, which, according to the common theory, ſhould have indicated the expulſion of a great quantity of phlogiſton; yet the whole reſiduum, of which the fixed air, produced by the ſuppoſed union of the phlogiſton or principle of inflammability, was only a part, ſcarce amounted ſometimes to one-fourteenth of the air originally employed.

154 The objection inconcluſive.

The argument, however, inſtead of contradicting the exiſtence of phlogiſton, only ſhows, that in ſome caſes the diſſipation of a very ſmall quantity of phlogiſton is neceſſary to inflammation; or that the aerial principle may combine with the iron in its metallic ſtate. In this caſe only a very little quantity of the phlogiſton of the iron was diſſipated; for it was

155 Iron is not reduced to a calx by burning in dephlogiſticated air.

not reduced to a calx, but to that kind of ſcoriæ which flies off in ſcales by beating the metal when red-hot with an hammer. A deciſive proof of this was had by uniting iron thus combined with the baſis of dephlogiſticated air with inflammable air. By this the metal was indeed reduced to perfect

156 Water produced in the reduction of it by inflammable air.

iron again; but water was produced at the ſame time from the union of the baſis of the two airs, that of the inflammable air being capable of furniſhing a ſuperfluous quantity, which united with the other into the form of a fluid.

157 Heat produced in the combuſtion of inflammable bodies derived from the air.

The exiſtence of phlogiſton being thus proved, and its nature aſcertained, we may now proceed to determine the queſtion, Whether the great quantity of heat produced by the combuſtion of inflammable bodies proceeds from the bodies themſelves, or from the air which muſt be admitted to them in order to make them burn? That the heat in this caſe proceeds from the atmoſphere is evident; becauſe in all caſes of combuſtion there is a certain diminution undoubtedly takes place by means of the converſion of the dephlogiſticated part of the atmoſphere into fixed air. It is proved, under the article *ELASTIC Vapours*, that elementary fire is the univerſal cauſe of elaſticity in fluids. By uniting a certain quantity of it with any ſubſtance, the latter at length aſſumes an aerial or vaporous form; and it is this vapour alone which is inflammable*. Different vapours no doubt contain different quantities of theſe ingredients; but in all caſes the baſis of the dephlogiſticated part of the atmoſphere

* See the article *Flame*.

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muſt unite with the phlogiſton of the inflammable body, or with ſomething elſe, ſo that a decompoſition may enſue: and it is this decompoſition which produces the heat and light; for then the fire contained in the atmoſphere having no longer any thing to abſorb it, muſt appear in its proper form.

158 Too much phlogiſton prevents the heat from being intenſe.

But in thoſe caſes where there is a great quantity of phlogiſton, and conſequently much fixed air produced, the latter abſorbs ſo much heat in a latent ſtate, that the quantity communicated to ſurrounding bodies muſt be greatly diminiſhed; and if an exceſs of this ingredient, not only fixed air, but the phlogiſticated kind and groſs ſmoke be alſo produced, this diminiſhes the heat ſtill farther by the great abſorption, and will even deſtroy it altogether. The remedy for this is either to diminiſh the quantity of phlogiſton, or to augment the quantity of air; which, by furniſhing a greater quantity of dephlogiſticated baſis, affords an opportunity for the evolution of a greater quantity of heat.

159 Too great a quantity of air has the ſame effect.

On the other hand, when the quantity of air is too great, the phlogiſtic matter cannot combine with the baſis of the pure air in ſufficient quantity to effect a decompoſition; and therefore the heat is abſorbed in a latent ſtate, and the fire goes out.

From this theory, which is farther illuſtrated under the articles FIRE, FLAME, HEAT, PHLOGISTON, &c. we may not only have a rational idea of the manner in which inflammation is generally accompliſhed, but ſee why a fire may be put out both by too great a quantity of fuel, and by too great a quantity of air.

160 Why the ſolar heat and that of electricity are ſo intenſe.

We may alſo ſee why the ſolar beams and electric fluid, which contain no phlogiſtic matter, excite a much more powerful heat than any we can raiſe in our hotteſt furnaces. The difference between ignition and inflammation will now likewiſe appear; ſuch bodies as are capable only of ignition containing little or no phlogiſton, but inflammable bodies a great deal.

161 Table of the various degrees of heat.

The following table ſhows the moſt remarkable degrees of heat from the congelation of mercury to that of Mr Wedgewood's hotteſt furnace.

| | |
|---|---|
| Mercury freezes at - - | 40 |
| Weak ſpirit of wine - - | 32 |
| Brandy at - - - | 10 |
| Cold produced by ſnow and ſalt mixed | 0 |
| Strong wine freezes at - | 20 |
| Vinegar freezes at - - | 27 |
| Water freezes at - - | 32 |
| Temperature of ſpring and autumn | 50 |
| Ordinary ſummer weather - | 65 |
| Sultry heat - - - | 75 |
| Heat of human blood - | 97 to 100 |
| Feveriſh heat - - | 108 |
| Bees wax melts - - - | 142 |
| Serum coagulates - - - | 156 |
| Spirit of wine boils - - | 174 |
| Water boils - - - | 212 |
| Tin melts - - - | 408 |
| Biſmuth melts - - | 460 |
| Oil of vitriol boils - - | 550 |
| Oil of turpentine boils - | 561 |
| Lead melts - - | 585 |
| Quickſilver and linſeed-oil boil - | 600 |
| Iron begins to ſhine in the dark - | 635 |
| Iron ſhines briſkly in the dark - | 750 |
| Iron ſhines in the twilight - | 884 |
| Iron red-hot from a common fire | 1050 |
| Red heat fully viſible in day light according to Mr Wedgewood - | 1077 |
| Heat by which his enamel colours are burnt on - - - | 1857 |
| Braſs melts - - - | 3807 |
| Swediſh copper melts - - | 4587 |
| Fine ſilver melts - - | 4717 |
| Fine gold melts - - | 5237 |
| Leaſt welding heat of iron - | 12777 |
| Greateſt ditto - - | 13427 |
| Greateſt heat of a common ſmith's forge - - - | 17327 |
| Caſt iron melts - - | 17977 |
| Greateſt heat of Wedgewood's ſmall air-furnace - - - | 21877 |
| Extremity of the ſcale of his thermometer - - - | 32277 |

Elective Attraction.

SECT. II. *Of the Doctrine of Elective Attraction, and of the different Objects of Chemiſtry.*

162 Chemical attraction.

BEFORE we proceed to give a general theory of the changes which happen upon the mixtures of different bodies together, or expoſing them ſingly to heat, we muſt obſerve, that all depend on certain qualities in bodies, by which ſome of them are apt to join together, and to remain united while they have an opportunity. The cauſe of theſe qualities is totally unknown; and therefore philoſophers, after the example of Sir Iſaac Newton, have expreſſed the apparent effect of this unknown cauſe by the word *attraction*. From them the word has been adopted by the chemiſts, and is now generally uſed in ſpeaking of the phenomena which are obſerved in the mixture of different ſubſtances; but to diſtinguiſh it from other kinds, it is uſually called *Elective*.

This attraction is not equally ſtrong between all ſubſtances; in conſequence of which, if any body is compounded of two others, and another is preſented to it which has a greater attraction for one of the component parts than they have for one another, the ſubſtance will be *decompounded*. A new compound is then formed by the union of that third ſubſtance with one of the component parts or *elements* (if we pleaſe to call them ſo) of the firſt. If the attraction between the body ſuperadded and either of the component parts of the other is not ſo ſtrong as that between themſelves, no decompoſition will enſue; or if the third ſubſtance is attracted by both the others, a new compoſition will take place by the union of all the three.

163 Objects of chemiſtry how claſſed.

The objects of chemiſtry, as we have already obſerved, are ſo various, that an enumeration of them all is impoſſible. To eaſe the mind, therefore, when ſpeaking of them, and render more uſeful any thing that is ſaid or wrote on chemiſtry, it is neceſſary to divide them into different claſſes, comprehending in each claſs thoſe bodies which have the greateſt reſemblance to one another, and to which one common rule applies pretty generally.—The diviſion formerly uſed, was that of vegetables, animals, and minerals; but this has been thought improper, as there are many ſubſtances in each of thoſe kingdoms which differ very widely from one another, and which are by no means ſubject to the ſame laws. The moſt approved method, Salts. thod, at present, of arranging the objects of chemistry, is into salts, earths, metals, inflammable substances, waters, animal and vegetable substances.

## Sect. III. *Salts.*

164 Salts.

Salts are either *fusible*, that is, capable of abiding the fire, and melting in a strong heat, without being dissipated; or *volatile*, that is, being dispersed in vapour with a small heat. Their other properties are, that they are soluble in water: not inflammable, unless by certain additions; and give a sensation of taste when applied to the tongue.

The most general characteristic of salts is, that they are all soluble in water, though some of them with much more difficulty than others. Most of them have likewise the property of forming themselves, in certain circumstances, into solid transparent masses of regular figures, different according to the different salt made use of, and which are termed *crystals* of that salt. In this state they always contain a quantity of water; and therefore the utmost degree of purity in which a salt can be procured, is when it has been well crystallized, and the crystals are freed of their superfluous moisture by a gentle heat. They generally appear then in the form of a white powder.

165 Phenomena attending their solution.

In the solution of salts in water, the first thing observable is, that the water parts with the air contained in it; which immediately rises to the top in the form of bubbles. This, however, is most remarkable when the salt is in the dry form we have just now mentioned, because there is always a quantity of air entangled among the interstices of the powder, which rises along with the rest; and this discharge of air is sometimes so great, as to be mistaken for an effervescence. From this, however, it is essentially different. See Effervescence.

Another thing observable in the solution of salts is, that a considerable change happens in the temperature of the water in which they are dissolved; the mixture becoming either a good deal warmer or colder than either the salt or the water were before. In general, however, there is an increase of cold, and scarce any salt produces heat, except when it has been made very dry, and deprived of that moisture which it naturally requires; and thus the heating of salts by being mixed with water may be explained on the same principle with the heat produced by quicklime. See Quicklime.

After salt has been dissolved in a certain quantity by water, no more of that salt will be taken up unless the water is heated; and as long as the heat continues to increase, the salt will be dissolved. When the water boils, at which time it has attained its greatest heat, and will take up no more salt, it is then said to be *saturated* with that salt. This, however, does not prevent it from taking up a certain quantity of another salt, and after that perhaps of a third, or fourth, without letting go any of the first which it had dissolved. How far this property of water extends, has not yet been ascertained by experiments.

To the above rule there is only one exception known as yet; namely, common sea-salt: for water dissolves it in the very same quantity when cold as when boiling hot. It has been said by some, that all deliquescent salts, or those which grow moist on being exposed to the air, had the same property: but this is found to be a mistake.

166 Mixture and separation of salts.

This property of solubility, which all the salts possess in common, renders them easily miscible together; and the property by which most of them shoot into crystals, renders those easily separable again which have no particular attraction for one another. This is likewise rendered still more easy by their requiring different proportions of water, and different degrees of heat, to suspend them; for by this they crystallize at different times, and we have not the trouble of picking the crystals of one out among those of the other.

167 Hypothesis concerning the solution of salts.

The manner in which the solution of salts in water is effected, is equally unaccountable with most of the other operations of nature. Sir Isaac Newton supposed that the particles of water got between those of the salt, and arranged them all at an equal distance from one another: and from this he also accounts for the regular figures they assume on passing into a crystalline form; because, having been once arranged in an orderly manner, they could not come together in disorder, unless something was to disturb the water in which they were suspended; and if any such disturbance is given, we find the crystals are by no means so regular as otherwise they would have proved. Others have thought that these figures depend on a certain *polarity* in the very small particles into which the salt is resolved when in a state of solution. These things, however, are merely conjectural; neither is it a matter of any consequence to a chemist whether they are right or wrong.

168 Salts destructible by repeated solutions.

Though solution is that operation which salts undergo the most easily, and which should seem to affect them the least of any, a repetition of it proves nevertheless very injurious to them, especially if it is followed by quick evaporation; and the salt, instead of being crystallized, is dried with a pretty strong heat. Newman relates, that a pound of sea-salt was reduced, by 13 solutions and exsiccations, to half an ounce; and even that was mostly earth. Where solution is required, therefore, it ought always to be done in close vessels, in which also the subsequent evaporation should be performed, (see Evaporation); and in all cases where crystallization is practicable, it ought to be preferred to violent exsiccation.

169 Acids.

The two great divisions of salts are into acids and alkalies. The former of these are known by their peculiar taste, which is called *acid* or *sour*. They are not found in a solid form; neither are any of them, except the acids of vitriol, of tartar, of phosphorus, and of borax, capable of being reduced to solidity. The others, when highly concentrated, that is, brought to the utmost degree of strength of which they are capable, always become an invisible vapour, permanently elastic, until it comes in contact with water, or some other substance with which they are capable of uniting. For such acids the name of *salts* seems less proper, as we can scarcely say that a *vapour*, which is already much more fluid than water, can be *dissolved* in that element.

The acids are divided into the mineral, the vegetable, and the animal; expressing their different origin, or where they are most commonly to be found. The mineral acids are commonly reckoned three; the

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vitriolic, the nitrous, and the marine. To this the acid of borax ought to be added; but its weakneſs makes it much leſs taken notice of as an acid than the others. A Swediſh chemiſt, however, Mr Scheele, hath lately added ſeveral others, which are afterwards taken notice of.

The vegetable kingdom affords only two diſtinct ſpecies of acids, at leaſt without the aſſiſtance of ſome chemical operation. The one appears fluid, and when concentrated to the utmoſt degree becomes an inviſible vapour. This is produced from fermented liquors, under the name of *vinegar*. An acid ſimilar to this, and which is thought not to be eſſentially different from it, is extracted from moſt vegetables by diſtillation with a ſtrong fire. The other is likewiſe a conſequence of fermentation; and cruſts on the bottom and ſides of caſks in which wine is put to depurate itſelf. In its crude ſtate it is called *tartar*; and when afterwards purified, is called the *cream*, or cryſtals, of tartar. As for the various acids produced in the different chemical proceſſes to be afterwards related, we forbear to mention them at preſent, it being juſtly ſuſpected that ſome of them are artificial.

The animal acids, which have hitherto been diſcovered, are only two; the acid of ants, and that of urine, which is alſo the acid of phoſphorus. The firſt of theſe is volatile; and conſequently muſt be ſuppoſed a vapour when in its ſtrongeſt ſtate: the other is exceedingly fixed; and will rather melt into glaſs than riſe in vapours. Beſides theſe, it is ſaid an acid is contained in blood, in waſps, bees, &c.: but no experiments have as yet been made on theſe to determine this matter with any degree of preciſion.

170 Alkalies.

The alkalies are of two kinds; fixed and volatile. The fixed kind are ſubdivided into two; the vegetable, and mineral or foſſil alkali. The vegetable is ſo called, becauſe it is procured from the aſhes of burnt vegetables; the foſſile, becauſe it is found native in ſome places of the earth, and is the baſis of ſea-ſalt, which in ſome places is dug out of mines in vaſt quantity. They are called *fixed*, becauſe they endure a very intenſe degree of heat without being diſſipated in vapour, ſo as even to form a part of the compoſition of glaſs. The volatile alkali is generally obtained by diſtillation from animal ſubſtances. In its pure ſtate this alkali is perfectly inviſible; but affects the ſenſe of ſmelling to ſuch a degree, as not to be approached with ſafety.

171 Different action of alkalies and acids.

The acids and alkalies are generally thought to be entirely oppoſite in their natures to one another. Some, however, imagine them to be extremely ſimilar, and to be as it were parts of one ſubſtance violently taken from each other. Certain it is, that when ſeparated, they appear as oppoſite to one another as heat and cold. Their oppoſite action indeed very much reſembles that of heat and cold, even when applied to the tongue; for the alkali has a hot, bitter, burning taſte, while the acid, if not conſiderably concentrated, always gives a ſenſation of coldneſs. In their action too upon animal ſubſtances, the alkali diſſolves, and reduces the part to a mucilage; while the acid, if not very much concentrated, tends to preſerve it uncorrupted.

172 Neutral ſalts.

If an alkaline ſalt, and moderately ſtrong acid in a liquid ſtate, be mixed together, they will immediately unite; and, provided the alkali has not been deprived of its fixed air, their union will be attended with a very conſiderable effervеſcence: (ſee Aerology.) If the alkali has been deprived of air, no effervеſcence will enſue, but they will quietly mix together; but if a due proportion of each has been added, the liquor will neither have the properties of an acid nor an alkali, but will be what is called *neutral*. The bringing the liquor into this ſtate, is called *ſaturating* the acid or alkali, or combining them to the point of ſaturation.

If the liquor after ſuch a ſaturation be gently evaporated, a ſaline maſs will be left, which is neither an acid nor an alkali, but a new compound formed by the union of the two, and which is called a *perfect neutral ſalt*. The epithet *perfect* is given it, to make a diſtinction between the ſalts formed by the union of an acid and an alkali, and thoſe formed by the union of acids, with earthy or metallic ſubſtances; for theſe will likewiſe unite with acids, and ſome of the compounds will cryſtallize into regular figures; but, becauſe of their weaker union with theſe ſubſtances, the ſalts reſulting from combinations of this kind are called *imperfect*.

173 Vegetable colours changed by acids and alkalies.

All acids, the volatile ſulphureous one excepted, change the blue infuſions of vegetables, ſuch as violets, to a red; and alkalies, as well as ſome of the imperfect neutrals, change them to green. This is the niceſt teſt of an acid or alkali abounding in any ſubſtance, and ſeems the moſt proper method of determining whether a ſolution intended to be neutral really is ſo or not.

174 Differences in the degrees of attraction between acids and alkalies

Though between every acid and alkali there is a very ſtrong attraction, yet this is far from being the ſame in all; neither is it the ſame between the ſame acid and alkali in different circumſtances of the acid. When the acids are in a liquid ſtate, and as free as poſſible of inflammable matter, between which and the nitrous and vitriolic acids there is a very ſtrong attraction, the vitriolic will expel any of the reſt from an alkaline baſis, and take its place. Thus, if you combine the acid of ſea-ſalt, or marine acid, to the point of ſaturation, with the foſſil alkali, a neutral ſalt will be formed, which has every property of common ſalt: but, if you pour on a certain proportion of the vitriolic acid, the acid of ſea-ſalt will immediately be expelled; and the liquor, upon being evaporated, will contain not the neutral ſalt formed by an union of the marine acid with the alkali, but another conſiſting of the vitriolic acid joined with that alkali, and which has quite different properties from the former.

When the acids and alkalies are applied to one another in a liquid ſtate, the vitriolic acid always ſhows itſelf to be the moſt powerful; but when applied in a ſolid form, and urged with a violent heat, the caſe is very much altered. Thus, the acid of borax, commonly called *ſal ſedativus*, is ſo weak as to be diſengaged from its baſis by every acid applied in a liquid form, that of tartar alone excepted; but if even the vitriolic acid combined with an alkali be mixed with this weak acid, then exſiccated, and at laſt urged with a vehement fire, the vitriolic acid will be diſengaged from its baſis, and riſe in vapours, leaving the weaker acid in poſſeſſion of the alkali. The ſame thing happens on adding the phoſphorine or urinous acid, Salts.

acid, or the acid of arsenic, &c. to combinations of the vitriolic or other acids with alkaline salts.—When the acids are in a liquid state, therefore the most powerful is the vitriolic; next the nitrous; then the marine; then vinegar; acid of ants: and lastly the sal sedativus and tartar, which seem to be nearly equal in this respect.—If they are applied in a solid form, the most powerful are the sal sedativus and phosphorine acid; then the vitriolic, nitrous, marine, and vegetable acids.

When they are reduced to vapour, the case is exceedingly different; for then the marine acid appears to be the most powerful, and the vitriolic the least so of any. It is impossible, however, to preserve the vitriolic acid in the form of vapour, without combining it with a certain quantity of inflammable matter, which must necessarily destroy its strength. Dr Priestley found, that the marine acid, when reduced to vapour, was capable of disuniting the nitrous acid from a fixed alkali.

Though the vitriolic acid sometimes assumes a solid form, it is by no means easy to reduce it to this state by mere concentration, without the assistance of nitrous acid. Baldasart, however, pretends that he discovered, in the neighbourhood of a volcano, a pure and icy oil of vitriol, from which nothing could be precipitated by alkaline salts; though there is certainly very great reason to doubt the accuracy of this observation. Of late the nitrous acid has also been found capable of assuming a solid form. This was first observed by M. Bernhard in distilling a very large quantity of the acid. At that time he perceived a white salt adhering to the inside of the receiver, which on examination proved to be the acid of nitre in a concrete form; being extremely corrosive, emitting red vapours copiously on being exposed to the air, and at length totally evaporating in it. Its specific gravity, however, was far inferior to that of the glacial oil of vitriol.

175 Acids unite with phlogiston.

The acids have the property of uniting themselves to many other substances besides fixed alkalies, and forming neutral compounds with them. Of these the chief is the principle of inflammability or phlogiston. In the vitriolic, nitrous, and phosphorine acids, the attraction for this principle is very strong; so great, that the two former will even leave a fixed alkali to unite with it. In the marine acid it is less perceptible; in the liquid vegetable or animal acid still less; and in the acid of tartar, and sal sedativus, not at all.

176 With metals and earth.

Besides this, all acids will dissolve metallic and earthy substances: with these, however, they do not in general unite so firmly with alkaline salts; nor do they unite so strongly with metals as with earths.

177 Elective attractions.

In general, therefore, we may expect, that after having dissolved a metal in any acid whatever, if we add an earthy substance to that solution, the acid will quit the metal, which it had before dissolved, to unite with the earth. In this case the solution will not be clear as before, but will remain muddy, and a quantity of powder will fall to the bottom. This powder is the metalline substance itself, but deprived of one of its component parts; and in this case it is said to *precipitate* in the form of a *calx*.

If to this new solution of the earthy substance in an acid liquor, a volatile alkaline salt, not deprived of its fixed air, is added, the acid will quit the earth, and unite wi ththe alkaline salt. The earth thus disengaged will again *precipitate*, and lie at the bottom in fine powder, while the volatile alkali and acid remain combined together, and the liquor again becomes clear.

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The attraction between volatile alkalies and acids is considerably less than between fixed alkalies and the same acids. If, therefore, a fixed alkali be now added to the liquor, the volatile alkali will be separated, and the acid will unite with the fixed alkali. The volatile alkali indeed, being perfectly soluble in water, cannot precipitate, but will discover its separation by the pungent smell of the mixture; and upon evaporating the liquor, the volatile alkali will be dissipated, and a saline mass, consisting of the acid and fixed alkali, will remain.

178 Detonation of nitre.

Lastly, If the acid employed was the nitrous, which has a strong attraction for the principle of inflammability, if the saline mass be mixed with a proper quantity of inflammable matter, and exposed to a strong heat, the acid will leave the alkali with vast rapidity, combine with the inflammable matter, and be destroyed in flame in a moment, leaving the alkali quite pure.

179 Exceptions to the above rules.

Though the abovementioned effects generally happen, yet we are not to expect that they will invariably prove the same whatever acid is made use of; or even that they will be the same in all possible variety of circumstances in which the same acid can be used.—The acid of tartar is one exception, where the general rule is in a manner reversed; for this acid will quit a fixed alkali for an earth, especially if calcined, and even for iron. If lead, mercury or silver, are dissolved in the nitrous acid, and a small quantity of the marine acid is added, it will separate the stronger nitrous acid, and fall to the bottom with the metals in form of a white powder.—The vitriolic acid, by itself, has a greater attraction for earthy substances than for metals; and greater still for fixed alkaline salts than for either of these: but if quicksilver is dissolved in the nitrous acid, and this solution is poured into a combination of vitriolic acid with fixed alkali, the vitriolic acid will quit the alkali to unite with the quicksilver. Yet quicksilver by itself cannot easily be united with this acid. The reason of all these anomalies, however, is fully explained in the following section.

## § 1. *Of the Operations of Solution and Precipitation.*

The chemical solution of solid bodies in acid or other menstrua, is a phenomenon which, though our familiarity with it has now taken off our surprise, must undoubtedly have occasioned the greatest admiration and astonishment in those who first observed it. It would far exceed the limits of this treatise to speak particularly of all the various circumstances attending the solution of different substances in every possible menstruum. The following are the most remarkable, collected from Mr Bergman's Dissertion on Metallic Precipitates.

180 Phenomena attending the solution of a metal.

1. On putting a small piece of metal into any acid, it is dissolved sometimes with violence, sometimes gently, according to the nature of the menstruum and of the metal to be dissolved.

2. The nitrous acid is the most powerful in its action

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tion upon metallic substances, when unassisted by heat. So great indeed is the violence with which this acid sometimes acts, that the metal, instead of being dissolved, separates instantaneously from it in the form of a calx or powder scarce soluble in any menstruum, at the same time that the heat, effervescence, and noxious vapours issuing from the mixture, render it absolutely necessary to moderate the action of the menstruum, either by dilution or cold, or both. In other cases, however, as when put to gold or platina, the nitrous acid has no effect until it be united with the marine, when the mixture acts upon those metals, which neither of the acids singly would touch.

181 Nitrous acid the most violent in its operation.

182 Vitriolic acid acts more weakly.

3. The action of the vitriolic acid, though in the higest degree of concentration, is more weak. It does not readily attack silver or mercury unless assisted by a boiling heat, nor will even that be sufficient to make it act upon gold or platina.

183 Marine acid generally more weak than either, except when dephlogisticated.

4. The action of marine acid, unless on some particular substances, is still more weak; but when dephlogisticated, or deprived of part of the phlogiston essential to its constitution as an acid, it acts much more powerfully, and dissolves all the metals completely.

184 The rest of the acids much weaker still.

5. The other acids, as those of fluor, borax, with such as are obtained from the animal and vegetable kingdoms, are much inferior in their powers as solvents, unless in very few instances.

185 Different degrees of solubility in metals.

6. Metals vary very much in their degrees of solubility; some yielding to almost every menstruum, and others, as has been already observed, being scarce acted upon by the most powerful.

186 Solution sometimes promoted by abstracting a certain proportion of phlogiston.

187 But is totally prevented by taking away too much: exemplified in manganese.

7. Zinc and iron are of the former kind, and gold and silver of the latter, eluding the marine; and gold, unless in one particular case, viz. when assisted by heat in a close vessel, the action of the nitrious acid also. These metals, however, which in their perfect state resist the action of the most powerful menstrua, may be dissolved much more readily when deprived of a certain quantity of their inflammable principle. But though the separation of this principle in some degree renders metals more soluble, the abstraction of too much of it, particularly in the case of iron and tin, renders these metals almost entirely insoluble. Manganese is the most remarkable instance of this power of the phlogistic principle, in depriving metals of their solubility by its absence, or restoring it to them by its presence; for this substance, when reduced to blackness, cannot be dissolved by any acid without the addition of some inflammable matter; but when by the addition of phlogiston it has become white, may be dissolved in any acid.

188 Solution of metals attended with an effervescence.

8. The dissolution of metals by acids, even to their very last particle, is attended by a visible effervescence: this is more perceptible according to the quickness of the solution; but more obscure, and scarcely to be seen at all, when the solution proceeds slowly.

189 Various kinds of elastic fluids extricated.

9. The elastic fluids extricated by these solutions are various, according to the nature of the acid and of the metal employed. With the nitrous, the fluid produced is commonly that called *nitrous air*; with vitriolic and marine acids the produce is sometimes inflammable air, sometimes otherwise, acccording to the nature of the metal acted upon.

10. Heat in a greater or smaller degree is always produced during the dissolution of metals; and the degree of it is in proportion to the quantity of the matter and the quickness of the solution; and hence, in small quantities of metal, and when the solution proceeds very slowly, the temperature of the mass is scarcely altered.

190 Heat produced during the dissolution of metals.

191 Little air can be obtained from metals when calcined.

11. The calces of metals either yield no air at all, or only the aerial acid, unless when urged by a violent heat almost to ignition; when, by means of vitriolic or nitrous acid, they yield a quantity of pure air, after other elastic fluids, such as vitriolic, nitrous, or phlogisticated air. None of the dephlogisticated air is usually produced by the marine acid in conjunction with metallic calces.

192 Various colours of metallic calces.

12. The solutions of some metals are coloured, others are not. The colour of the former is only that which is proper to the calx, but rendered more vivid by the moisture. Thus solutions of gold and platina are yellow; those of copper, blue or green; solutions of nickel of a bright green; but those of cobalt are red, although the calx is black. We may observe that even this red colour may be heightened to blackness. Iron moderately calcined is green; but this rarely continues upon further dephlogistication. The white calces of silver, lead, tin, bismuth, arsenic, antimony, and manganese, are dissolved without colour; but solutions of lead, tin, and antimony, are somewhat yellow, unless sufficiently diluted. Mercury, however, forms a singular exception to this rule; for the orange-coloured calx of this metal forms a colourless solution. The metals yielding coloured solutions are gold, platina, copper, iron, tin, nickel, and cobalt; the rest, if properly depurated, give no tinge. A solution of silver is sometimes of a blue or green colour at first, although there be no copper present; the vitriolic acid becomes blue with copper; the nitrous may be made either blue or green at pleasure; the marine varies according to the quantity of water with which it is diluted. Manganese, when too much dephlogisticated, renders both the vitriolic and marine acids purple.

193 Bergman's account of the cause of chemical solution.

With regard to the cause of chemical solutions, our author observes, that though attraction must be looked upon as the fundamental cause, yet we may also lay it down as a maxim, that no metal can be taken up by an acid, and at the same time preserve the whole quantity of phlogiston which was necessary to it in its metallic state. A certain proportion of the principle of inflammability therefore may be considered as an obstacle which must be removed before a solution can take place. Thus, of all the acids, the nitrous attracts phlogiston the most powerfully, and separates it even from the vitriolic. A proof of this may be had by boiling sulphur slowly in concentrated nitrous acid. At length all its phlogiston may be separated, and the vitriolic acid will remain, deprived of its principle of inflammability. The extraordinary solvent powers of this acid, therefore, is conformed to the peculiarity of its nature in this respect. For this menstruum dissolves metals for solution with the greatest ease, most commonly without any assistance from external heat; which in some instances would be hurtful, by separating too much of phlogiston, as appears in the case of iron, tin, and antimony; all of which may be so far dephlogisticated by the nitrous acid, as to be rendered extremely difficult of solution: for this reason it is very often necessary, as has already been observed, to temper the activity

194 Solution impeded by too great a quantity of phlogiston.

159 Sulphur dephlogisticated by nitrous acid.

196 Calces of some metals prepared by nitrous acid almost insoluble ever afterwards.

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activity of this menstruum by water. The vitriolic acid requires a boiling heat before it can act upon silver or mercury. The reason of this is, that by means of the heat, the watery part of the menstruum is diminished, its power is thereby increased, and the connection of the metallic earths with the inflammable principle diminished. Marine acid, which contains phlogiston as one of its constituent principles, must necessarily have little or no effect on those metals which retain their principle of inflammability very obstinately. But its watery part being diminished by boiling, it assumes an aerial form, and powerfully attracts a larger quantity of phlogiston than before; so that in a vaporous state it will dissolve metals, particularly silver and mercury, which in its liquid form it would scarce be brought to touch. When dephlogisticated as much as possible, it attracts phlogiston with prodigious avidity, dissolving all metals by its attraction for their phlogiston, and, uniting the inflammable principle to itself, resumes the ordinary form of marine acid. When dephlogisticated by means of nitrous acid in aqua regis, it dissolves gold and platina. On the same principles may we account for its inferiority in power to the other acids.

197 Why the vitriolic acid cannot act on lead, silver, &c. without a boiling heat.

198 Why marine acid acts on some metals and not on others.

199 Why some metals are more soluble than others.

It has already been observed that the metals differ much in their degrees of solubility, which is owing to the various, degrees of force with which they retain their phlogiston. Those called perfect metals effectually resist calcination in the dry way. In this operation, the fire on the one hand, the great cause of the volatility of bodies, strenuously endeavours to expel the phlogiston; on the other hand, the basis of the dephlogisticated part of the atmosphere (the acidifying principle of M. Lavoisier, and the *principium sorbile* of Dr Lubbock) attracts the calx strongly. Experience, however, shows, that these two forces united, cannot decompose gold, silver, or platina to any considerable degree. All the other metals yield to these forces when united, but not singly. Iron and zinc retain their inflammable principle so slightly, that any acid immediately acts upon them; but if the other metals be properly prepared for solution by being calcined to a certain degree, the acid will immediately take them up.

200 Why nitrous acid precipitates a solution of tin or antimony.

Any further privation, however, would be injurious, and precipitate what was before dissolved. Thus the nitrous acid, when added to a solution of tin or antimony in marine acid, by its extraordinary attraction for phlogiston carries off such a quantity of it, that the calces of the metals are immediately precipitated.

201 Different kinds of air produced during the dissolution of metals.

The various elastic fluids which resemble air, and which are produced in plenty during the dissolution of metals, may be reduced to the following, *viz.* those extricated by the vitriolic, nitrous, and marine acids, fluor acid, vinegar, alkaline salts, and hepar sulphuris.

202 Pure vitriolic acid cannot be reduced into an aerial form but by a combination with phlogiston.

Pure vitriolic acid exposed to a violent heat, is indeed resolved into vapours, but of such a nature, that when the heat is gone, they condense again into an acid liquor of the same nature as before. But if any substance be added which contains phlogiston in a separable state, an elastic fluid is produced by means of fire, which is scarcely condensible by the most extreme cold, unless it comes in contact with water. This is called the volatile sulphureous acid, or vitriolic acid air, which may be totally absorbed by water. In this case the bond of union betwixt it and the phlogiston is so weak, that the latter soon flies off totally, and common vitriolic acid is regenerated.

203 Nitrous acid more obviously changed.

The nitrous acid undergoes a similar change in a more obvious manner. Let a piece of silver, for instance be put into a dilute nitrous acid, and the surface of the metal will instantly be covered with innumerable bubbles, which arising to the top of the liquor, there burst; and if collected, are found to be nitrous air.

204 Why nitrous air does not unite with water.

The nitrous acid saturates itself with phlogiston more completely than the vitriolic; therefore the elastic fluid produced, or nitrous air, does not unite with water, and scarce retains any vestige of an acid nature. The vitriolic acid, however, differs from the nitrous in this respect, that the phlogiston is absorbed by the latter even beyond the point necessary to obliterate its acid nature. In proof of this, our author adduces the decomposition of hepatic by means of nitrous air.

205 Phenomena exhibited by the marine acid.

The marine acid exhibits different phenomena. It naturally contains phlogiston, and therefore can by its means be resolved into a kind of air somewhat similar to that produced by the vitriolic acid when artificially united to the same principle, and which has the same property, *viz.* that of remaining permanently elastic as long as it is kept from the contact of water. But as the acid we speak of naturally contains phlogiston, there is no necessity of adding more to produce this effect. In the mean time, the marine as well as nitrous air, when in its expanded state, attracts phlogiston, and that with wonderful avidity.

206 Of the dephlogisticated marine acid.

When the marine acid is dephlogisticated, it yields another elastic fluid of a reddish brown colour, having an odour like that of warm aqua regia. This does not unite with water, or only in very small quantity: and by the addition of a proper proportion of phlogiston may be reduced again to common marine acid. It is said that the marine acid may be dephlogisticated by lead as well as by manganese, the nitrous acid, and arsenic.

207 Of the fluor acid.

The fluor acid abounds with phlogiston, and therefore may, without any adventitious matter, be reduced to an elastic fluid. This air is easily distinguished from all others by its corrosion of glass whilst hot.

208 Why vinegar may be reduced into air without addition.

Vinegar also contains phlogiston; and for that reason, when well dephlegmated, may be reduced without addition into a permanently elastic fluid, called acetous air.

209 Heat and not phlogiston the principle of elasticity.

All these fluids seem to be nothing else, according to Mr Bergman, than the acids themselves expanded by phlogiston. "Perhaps (says he) the matter of heat also enters their composition." The experiments lately made on these subjects, however, have put it beyond all doubt, that the expansive principle is not phlogiston but heat; nevertheless, it seems highly probable, that these elastic fluids do really consist of the acid united to phlogiston, and expanded by heat. This is also the case with the caustic volatile alkali, now called alkaline air.

210 Sulphur exists in hepatic air.

In the hepatic air, it has been shown by Mr Bergman, that sulphur exists which contains phlogiston; and there is little reason to doubt that the expansive power here is the same as in other cases. See Hepatic Air.

The heat generated during the solution of metals is by Mr Bergman supposed to be owing to the matter of

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of heat which had been fixed in the metals; but it may with much more reason be supposed to proceed from the acid. Dr Black has demonstrated, that heat is universally the principle of fluidity; and all fluids,

211 Heat in solution most probably proceeds from the solvent liquor.

whether acid or not, are found to contain a great quantity of it. It is not probable that solids, even the most inflammable, contain an equal quantity; for it is always observed, that bodies in becoming fluid absorb heat, and throw it out again on becoming solid. Acids in all probability contain a much greater quantity than what is necessary to their fluidity; for we see that the nitrous acid, when poured upon snow, parts with as much heat as is necessary to dissolve the snow, at the same time that it still retains its fluidity. The case is not so with common salt, which is a solid: for though, in a mixture of salt and snow, the latter absorbs as much heat from the salt as is necessary for its own liquefaction; yet the salt could not be held in solution by a liquid of this temperature, were it not that an additional quantity is perpetually absorbed from the adjacent bodies, particularly the atmosphere. But were it possible to prevent this adventitious increase of heat, there is not the least reason to believe that the salt would be dissolved; for the strongest brine, when reduced to the temperature of 0 of Fahrenheit, is decomposed, the salt falling to the bottom in powder, and the water being converted into ice. Add to this also, that the cold produced by spirit of nitre and snow is much more intense than that produced by com-

212 Solid bodies do not part with so much heat as fluids.

mon salt and snow; which undoubtedly shows, that a solid does not readily part with as much heat as a fluid, and consequently cannot be supposed to contain as much. The solution of metals in acids also demonstrates, that the solid substance has not parted with heat, but absorbed it; for as soon as the solution becomes solid again, *i. e.* when it crystallizes, the temperature becomes higher than before.

213 Why little or no elastic fluid is obtained from metallic calces.

The calces of metals have not that quantity of phlogiston that is necessary for their metallic state, but yet are not entirely destitute of it; therefore, in their solution, scarce any elastic fluid is generated, unless the fire be continued after exsiccation. Such as contain aerial acid, discharge it immediately in the same form as they had received it. It is remarkable, that Dr Priestley mentions a calx of lead, which, with the acid of phosphorous, produced an inflammable air. By means of the nitrous acid and evaporation to dryness, a pure air is produced. Sometimes a small portion of vitriolic acid air is obtained by means of a proper degree of fire from vitriolic acid, but a far greater quantity of pure air.

214 Metallic solutions contain a calx of the metal with various degrees of phlogiston.

The solutions made by the menstrua abovementioned, contain a metallic calx intimately united with the acid, the quantity of phlogiston left being various according to the difference of the menstrua and of the temperature; but the performance of the operation either with or without intense heat, frequently occasions a remarkable difference. That metals are less calcined by the marine than by the nitrous acid, appears from pouring concentrated nitrous acid on tin or antimony; but the difference, if it actually does take place, is less visible in other metals.

Some modern chemists have denied this calcination of metals by solution. They have insisted, that the perfect metals ought to be excepted, as they do not yield to the most intense fire. On this subject, however, it may be observed, 1. That during their solution nitrous air is always generated, and that of a very perfect kind, which cannot happen without phlogiston; but in this case there is nothing present which can yield phlogiston except the metals. Therefore, 2. The metals, when precipitated from their menstrua by fixed alkalis, both with respect to their external appearance and internal properties, appear to be calcined. Thus the precipitate of gold refuses to unite with mercury, and may be dissolved by marine acid and other simple menstrua, and that without the production of any elastic fluid. 3. Glass may be stained by these calces; but no metal in its perfect state can be taken up by glass.

215 Reasons for believing that metals are calcined by phlogiston.

216 Why the calces of the perfect metals may be reduced without addition.

The common objection is, that the calces of the perfect metals may be reduced by heat alone without the addition of charcoal. Many theories have been invented to solve this phenomenon. Some have supposed, that the matter of heat and light are the same with the phlogiston, and that thus the calces are reduced in the same manner as by charcoal or other substances usually termed *phlogistic*. But in this case we ought to find the calces of the imperfect metals also reduced by a long continuance of heat, as well as the more perfect; which, however, has never yet been known to take place. Some, among whose number is Dr Lewis, have imagined, that the porosity of the vessels, particularly those made of earthen ware, may be such as to admit the passage of phlogistic vapours through them; and he instances the revival of globules of lead in the middle of pieces of glass upwards of an inch in thickness, and that where there was not the least appearance of a crack. But from an experiment of Mr Kirwan's to be afterwards related, it is much more probable that the reduction is effected by means of the phlogiston contained in one part of the calx attracted by another; by which means the latter is reduced to a perfect metal, while the former becomes somewhat more dephlogisticated. In consequence of this it appears, that the calx of the perfect metals is never totally reduced: for if the operation be performed in a glass retort, the bottom of it is always stained; which indicates the existence of a calx, in however little quantity.

217 Difficulty concerning the amalgamation of silver solved by Bergman.

The following fact, Mr Bergman says, has been proposed to him as an inextricable dilemma. "Silver cannot amalgamate with mercury except when in its metallic state, yet both salited and nitrated silver are taken up by mercury; it is therefore not calcined by the acids, but adheres to them in its metallic form." This, however, may be easily solved in the following manner. It is well known that the calx of copper, dissolved in the vitriolic acid, is precipitated in its metallic form on the addition of iron, and that by means of a double elective attraction; for the iron, dissolving in the acid, would form an inflammable air by its phlogiston, were not the copper present which takes it up, and thereby becomes insoluble as long as it retains it; but mercury has a stronger attraction for acids than silver: if therefore salited or nitrated silver be triturated with mercury, the silver must be precipitated in a metallic state, and the mercury be calcined by being dissolved. This also takes place, provided there be moisture sufficient to suffer the elective attrac-

tions

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tions to operate. The superabundant mercury greedily takes up the comminuted silver precipitate; and the *arbores Dianæ* are nothing more than such an amalgam crystallized. But although the acids cannot take up any metal while it retains its full proportion of phlogiston, various metallic salts are able to effect that solution. Thus nitrated or salited mercury, boiled in water together with the crude metal, can take up a certain portion of it without dephlogistication; and the latter of these salts, even in the *via sicca*, becomes a mercurius dulcis, which contains at the same time a crude and a calcined mercury.

218 Phlogiston the cause of colour in metallic solutions.

Perfect solutions should in general be transparent; but some, as has been already mentioned, are distinguished by a peculiar colour. That phlogiston is the chief cause of colour appears from hence, that the black clax of manganese tinges vitriolic acid of a red colour; but on the addition of sugar the tinge is entirely destroyed. Nitrous acid is rendered blue by copper; but when the metal is added in considerable quantity, it becomes of a very deep green. The marine acid, which dephlogisticates the copper less, is yet made green; but by dephlegmation may be so condensed as to become brown. Mr Bergman has sometimes seen a solution of silver green, without the presence of the smallest particle of copper. This depends on the absorption of nitrous air: for let smoking nitrous acid be diluted, on the addition of a certain quantity of water it will be of a deep green; by a greater, blue; and upon a still greater, becomes limpid. By means of the water, the nitrous air is extended to a greater space; and this attenuation gradually increased varies the colours. Hence we see why nitrous acid is made green by a large quantity of copper.

219 Attraction of phlogiston the cause of causticity.

Metals dephlogisticated by acid solvents powerfully attract phlogiston; nay, nitrated silver and mercury, and salited antimony, corrode animal substances, in order, as our author supposes, to extract it. "This metallic causticity (says he), which is only to be moderated by phlogiston, ought to be carefully distinguished from the acid causticity, which is repressed by alkalies, and the alkaline, which is mitigated by acids. Colours vary according to the quantity of phlogiston present; and some experiments show, that by a sufficient quantity all colour is entirely destroyed.

220 Phenomena attending the precipitation of metals by alkaline salts.

All metals may be precipitated by alkaline salts; which, by their superior power of attraction, separate them from their menstrua; but their difference with regard to their nature and preparation alters the nature of the precipitate. With the caustic fixed alkali the calces fall almost entirely pure, but loaded with water. The weight is found to be increased by the water, and perhaps (says Mr Bergman) by the matter of heat; but yet less than by the aerial acid. With the aerated fixed alkali, by means of a double decomposition, the aerial acid unites to most calces. The volatile alkali, which naturally contains phlogiston, sometimes phlogisticates the precipitate. It throws down a black or white precipitate of mercury; nay, it makes the orange-coloured precipitate white. Gold receives its fulminating quality from this precipitant, as is afterwards to be explained. The alkali, which is commonly called *phlogisticated*, generally precipitates metals with an increase of weight.

221 Precipitates occasioned by acids, and why;

The acids frequently occasion precipitates, and that for various reasons. By means of elective attraction, mercury, silver, and lead, are taken from the nitrous acid by the addition of the marine or vitriolic. These acids form with the metals new compounds which are difficult of solution in water; they are therefore precipitated in greater or lesser quantity according to circumstances. The nitrous acid is capable of decompounding salited tin and antimony by dephlogisticating the calx of the metals too much; for when these are too much calcined, they cannot be dissolved in any menstruum, as has been already observed.

222 By the perfect neutral salts;

Metallic solutions are sometimes disturbed by the neutral salts formed by an union of alkalies with acids. Those which contain the vitriolic or marine acids decompose solutions of silver, mercury, or lead, in nitrous acid, and precipitate the metals.

223 By a triple combination.

By forming a triple combination, the vegetable as well as the volatile alkali, though saturated with vitriolic, nitrous, or marine acid, precipitate platina from aqua regia; but when the basis is mineral alkali, the salt has no power of this kind.

224 Some metallic salts decompose others.

Some metallic salts can decompose others, and precipitate their bases; which may happen whether the acid be different in the two salts or not. Solution of gold affords an example of each of these cases.

225 Why solution of gold is precipitated by green vitriol;

This is precipitated by martial vitriol; the reason of which will appear from considering the nature of the precipitate: for this, when well washed and dried, not only shows many shining gold-coloured particles, but also unites with mercury by trituration, dissolves in aqua regia, but not in marine acid alone, together with other circumstances which evince a complete resuscitation of the gold. Martial vitrol, in its ordinary state, contains phlogiston, but very loosely adhering; so that the clax of gold may easily take it from the solution to supply the loss it had sustained during the solution.

226 But not by this salt when dephlogisticated.

That this is the true foundation of the process, appears also from the following circumstances, that the weight of the gold is exactly recovered, and that dephlogisticated vitriol will not precipitate this metal. The reason that the surrounding aqua regia leaves this precipitate untouched is, that the menstruum is diluted and weakened by a large quantity of water; for upon boiling it gently, so as to expel part of the water, the menstruum recovers its solvent power, and takes up the precipitate again.

227 Why solution of gold is precipitated by solution of tin.

It is somewhat more difficult to explain the reason why the solution of gold in aqua regia should be precipitated by a solution of tin in the same menstruum. Here Mr Bergman first supposed that the the tin had attracted a superabundance of acid, and taken it from the gold; which being therefore destitute of its proper quantity, must fall to the bottom: but on employing a solution containing a superabundant aqua regia, the same precipitation took place. The cause is therefore not in the menstruum. On examining the precipitate itself, we find nothing like the metallic splendor of gold, but that it entirely resembles a calx.

228 This precipitate consists partly of tin.

It is easily found by its weight, indeed, that it cannot consist entirely of gold; and in fact chemical examination shows that it consists partly of tin. It cannot be dissolved by the marine acid alone, but is easily taken up by the addition of a little nitrous acid. It scarcely unites with mercury by trituration. These properties seem to indicate, that the gold has so far received phlo-

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giston as to resist the marine acid until it receive the assistance of the nitrous; but its earthy appearance, and difficulty of uniting with mercury, evince that it is not in its complete metallic form. The following therefore, according to our author, seems to be the most easy and rational explanation. The solution of tin necessary for this operation must retain as much phlogiston as it possibly can, in a consistence with solubility. This is dropped into a solution of gold very much diluted; by which means the phlogiston remaining in the tin is more loosened, and of consequence more easily attracted by the gold calx, which is thereby brought to a state approximating to completion, so that it can no longer be retained by the menstruum; and the same happens to the tin, by means of the dephlogistication; they must both therefore fall to the bottom mixed intimately with one another. It is probable, says he, that in this case it is the tin which prevents the matter from uniting with mercury.

229 Precipitation of metals by one another, owing to a double elective attraction.

The metals precipitate onea nother after a certain order, which is the same in all acid menstrua. This precipitation is occasioned by a double elective attraction; for the metal to be precipitated exists in the solution in a calcined state; but being reduced by the phlogiston of the precipitant falls to the bottom, while at the same time the precipitant becomes soluble by calcination: but if the precipitant has been calcined so that a part of it being insoluble is mixed with the precipitate, the metallic splendor is wanting, and it puts on an earthy appearance. A pure precipitate is of the same weight with the metal before solution. The mixed precipitates are less frequently met with, yet gold precipitated by tin exhibits one of that kind.

230 Variations in the order in which the metals precipitate one another.

Though the order in which the metals precipitate one another is constant and never inverted, yet there are many anomalous circumstances which occur in the matter. Thus zinc constantly prevails over iron; iron over lead; lead over tin; tin over copper; copper over silver; silver over mercury, *&c.* yet it sometimes happens, that a metal which, according to the general rule, precipitates another in its metallic state from one menstruum, precipitates it from another in form of a calx, and not at all from a third. Thus zinc precipitates iron from marine acid in its metallic state, but from the nitrous only in form of a clax. Tin is precipated by lead from the marine acid in its metallic state, but is not thrown down from the nitrous acid; and from the acetous is precipitated even by iron and zinc in form of a clax; solution of lead in vinegar is not precipitated by iron.

231 Mineral alkali why preferred as a precipitant by Mr Bergman.

In Mr Bergman's experiments on this subject he employed the mineral alkali, as the degree of its saturation with fixed air was more constant. When he had occasion for a caustic alkali, he prepared it by a small quantity of burned lime kept in a close bottle; and the goodness of it was proved by its occasioning no precipitation in lime water. Phlogisticated alkali, or that by which Prussian blue is prepared, was also made use of. With these he made the following observations. Gold dissolved in aqua regia is precipitated by caustic alkali almost black; by the aerated, yellow, as well as by the phlogisticated, unless some iron be present, which frequently happens; but the whole of the gold is scarce ever precipitated, so that the weight cannot be ascertained.

232 How he prepared his caustic alkali.

233 Various precipitates of gold.

Neither the caustic nor aerated mineral alkali precipitate one half of platina dissolved in aqua regia; the precipitate is of an orange colour, which on dying becomes brown. An over-proportion of alkali redissolves the precipitate, and the liquor becomes more dark; nay, the precipitation is so imperfect, that the matter seems to be dissolved even by neutral salts. The phlogisticated alkali does not precipitate the depurated solution, nor even make it turbid, but heightens the colour in the same manner as an excess of alkali.

234 Mineral alkalies precipitate platina imperfectly.

235 Precipitates of silver.

Solution of silver in nitrous acid lets fall a white precipitate by the aerated alkali; brown by the caustic, and of an obscure yellow. By the nitrous and marine acids it lets fall a white precipitate, which with the former consists of more distinct particles, which grow black more slowly with the light of the sun.

236 Of mercury.

Salited mercury lets fall a red precipitate, or rather one of a ferruginous colour, by aerated alkali; but of a more yellowish or orange colour by the caustic. Nitrated mercury prepared without heat, yields a ferruginous precipitate with mineral alkali; a black with caustic: and when prepared with heat, it yields to caustic alkali an orange or reddish yellow precipitate. By phlogisticated alkali it is precipitated from all acids of a white colour; but turns of a brownish yellow when dry. Salited mercury is very sparingly precipitated by this alkali. The precipitate by phlogisticated alkali is again dissolved, if too much of the precipitant be made use of.—Corrosive sublimate must be very cautiously precipitated by caustic, as well as aerated fixed alkali; for the part separated may again be dissolved by a large quantity of water. When too much alkali is used, a new compound arises of a peculiar nature.

237 Precipitates of lead.

Solution of lead in spirit of nitre is precipitated down white by aerated, caustic, or phlogisticated alkali. By using too much alkali, the precipitate by the phlogisticated kind is dissolved with a brownish yellow colour. Vitriol of lead and solution of lead in marine acid are precipitated white.

238 Of copper;

Blue solution of copper in spirit of nitre is precipitated of a bright green by aerated fixed alkali; by the caustic of a greyish brown, which grows reddish by age. By phlogisticated alkali copper is precipitated of a greenish colour, which grows afterwards of a brownish red, and upon exsiccation almost black. The aerial acid takes up a small quantity of copper during the precipitation, which is again deposited by the heat of boiling.

239 Of iron;

Aerated fixed alkali precipitates iron of a green colour from vitriolic and marine acid; but the precipitate becomes of a brownish yellow, especially on exsiccation; with the caustic alkali it approaches more to black. In the precipitation some part is held in solution by the aerial acid, when the mild alkali is used. With phlogisticated alkali a Prussian blue is formed.

240 Of tin;

Tin is precipitated of a white colour by every alkaline salt, even by the phlogisticated kind; but at length some blue particles appear in the mixture: so that the whole, when collected and dried, appears of a light blue colour. That these blue particles are occasioned by iron appears by calcination; for they become ferru-

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ferruginous, and obey the magnet. Our author has always found a proportion of iron in tin.

241 Precipitates of bismuth;

Bismuth is thrown down of a fine white by water and alkalies, particularly the former; phlogisticated alkali throws down a yellow powder, which being mixed with blue particles occasioned by iron, at length appears green. This yellow sediment easily dissolves in nitrous acid.

242 Of nickel;

Nickel is precipitated of a whitish green by fixed alkalies; by the phlogisticated alkali of a yellow; and by exsiccation it is condensed into a dark brown mass.

243 Of arsenic;

Arsenic dissolved in acids, which prevent too great dephlogistication, may, to a certain degree, be precipitated white by the fixed alkali, even when phlogisticated, but the sediment is found soluble in water; yet nitrous acid, either alone, or joined with the marine, generally dephlogisticates the arsenical acid, which thereby becomes unfit for separation. Arsenic dissolved in marine acid, with the assistance of a little nitrous acid, deposited a white sediment on the addition of a large quantity of phlogisticated alkali. The sediment was mixed with Prussian blue. This was dissolved in water, and freed by frequent filtration from the blue particles; and at length, on evaporating to dryness, yielded a semipellucid mass.

244 Of cobalt;

Cobalt dissolved in acids is thrown down by fixed alkali, whether aerated or caustic, of a reddish blue, which grows darker on exsiccation, especially when the former alkali has been used. Phlogisticated alkali throws down a powder of almost the same colour, which, upon exsiccation, becomes of a reddish brown.

245 Of zinc;

Zinc is precipitated white by aerated and caustic fixed alkalies, as also by the phlogisticated alkali; but this last becomes of a citron colour on exsiccation: a small portion of aerial acid may easily escape during the precipitation.

246 Of antimony;

Antimony is precipitated white by alkalies. When the phlogisticated alkali is used, some blue particles are almost always precipitated at the same time, though the regulus had been prepared without any iron. This operation should be cautiously conducted, lest some part be taken up by the alkaline salt.

247 Of manganese.

Manganese procured by reduction from common magnesia nigra, generally renders menstrua brown, and with aerated alkali yields a yellowish brown sediment; with the caustic, one still darker; with the phlogisticated, first a blue, then a white, powder is separated, the mixture of which renders the mass a black green. To obtain a pure and white calx of manganese, we must dissolve in pure vinegar the precipitate thrown down by caustic alkali; for there still remains a quantity of iron which is taken up by the aerial acid. This acetous solution contains little or nothing of iron. That metal may also at first be separated by a small quantity of volatile alkali.

The common solution of the regulus is not perfectly precipitated by the aerated alkali; and upon evaporating the remaining liquor spontaneously to dryness, grains of a metallic splendor, and not unlike copper, are deposited on the glass. The nitrous acid attracts these readily, though they are only partially dissolved by it; but on the addition of zinc, nothing falls besides the manganese, though at first it is a little reddish. With phlogisticated alkali, we obtain a yellow precipitate like pure manganese, provided the solution has deposited the iron when too much dephlogisticated by age. But the new solution yields a precipitate almost like that which is obtained from common regulus. The yellow sediment may be dissolved in water.

248 On the cause of such great variations in the weight of precipitates.

The following is Mr Bergman's table of the quantities of precipitate of different metals, thrown down from various menstrua by the different alkalies. "On comparing the weights (says he), a question occurs concerning the cause of such enormous differences; and it is plain, that this cause must be sought for in the precipitates themselves.—The fixed alkali saturated with aerial acid, when added to the solution, is taken up by the more powerful menstruum; and the weaker is of course expelled, and is absorbed by the calx as it falls, in greater or lesser quantity according to circumstances. That this is actually the case is easily demonstrated:—Let a bottle containing a quantity of nitrous acid be accurately weighed. Let there be put into it, for instance, 132 parts of lead precipitated by aerated alkali; and not only an effervescence will be observed, which continues until the very last particle is dissolved, but when the solution is finished, a deficiency of weight is discovered, which amounts nearly to 21, and which is undoubtedly owing to the extrication of aerial acid. But $132-21=111$; a weight which still considerably exceeds that of the metal. Upon distillation nearly eight of water are discovered. There yet remain therefore three, which by violent heat are increased by seven; for 132 of the calx well calcined yield 110. The whole increment of weight then does not depend on the water and aerial acid. The same thing is evinced by considering the precipitate of lead by the caustic alkali; in which case there can be no aerial acid, nor does any effervescence accompany the solution. If we suppose the quantity of water equal in both cases, yet even on this supposition the whole excess of weight is not accounted for; for $116-8=108$. It is therefore probable, that the matter of heat is attached to the calx (A).—In proof of this opinion, and that caustic alkalies contain the matter of heat, our author adduces several arguments, of which the following is the strongest.—"Let the heat occasioned by the mixture of any acid and caustic alkali be determined by a thermometer; let then an equal portion of the same menstruum be saturated with a metal; afterwards, on the addition of an equal quantity of caustic alkali, it will be found, either that no heat is generated, or a degree very much less than before.—Some of the matter of heat therefore is taken up and fixed, which also generally makes the colours of the precipitates more obscure; and in distillation with sal-ammoniac, communicates to the volatile alkali the quantity that had been taken away."

249 Argument in favour of the weight of precipitates being augmented by the matter of heat.

250 Insufficient

In this instance also, however, our author seems to have been deceived. It has already been observed, that in all solutions generating heat, it most probably comes from the fluid. Acids contain a quantity sufficient

(A) This increase of weight is with more probability to be ascribed to a remainder of the acid.

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ficient not only for their own fluidity, but for rendering solid bodies fluid also. After they have dissolved the metal, however, this superfluous quantity is employed; and when the caustic alkali is added, if in a solid form, it is again employed in giving fluidity to the alkali; or if the alkali be already dissolved, the increased quantity of fluid makes the heat extricated less perceptible.

" What has been said of lead (continues our author), is also true of the other metals, a few excepted, which seem to take up little or no aerial acid; such are tin, antimony, gold and platina.—But some precipitates retain also a quantity of the menstruum.

251 A quantity of the menstruum retained by some precipitates.

Thus, corrosive mercury, precipitated by aerated alkali, retains a portion of marine acid, which cannot be washed off by water; but, by caustic alkali, the precipitate may be obtained, either free of the acid altogether, or in a great measure. In this case, as in many others, the aerial acid seems to generate a triple salt, scarce at all soluble. The presence of the marine acid is easily discovered by solution of silver in nitrous acid, if the menstruum has been pure.

252 Difference in the precipitates of mercury.

Hence we observe another difference in mercury precipitated from marine acid, according as we employ the aerated or caustic alkali; the latter, well washed, and put into volatile alkali, is scarcely changed in colour; but the former instantly grows white, generating a species of sal-alembroth, but containing so little marine acid as not to be easily soluble in water. The calces which retain any of their former menstruum, generally give over on distillation a small portion of sublimate. The mercurial calx just mentioned, exposed to a sufficient degree of heat, is partly reduced to crude mercury, partly to mercurius dulcis, by means of its remaining marine acid. This mercurius dulcis did not exist in the precipitate; for in that case it would be easily discovered by acids in which it is not soluble, and would grow black with caustic alkali, neither of which take place, so that it must be generated during the distillation."

253 Advantages to be derived from the examination of metallic precipitates.

Mr Bergman concludes his dissertation, with an enumeration of the advantages resulting from the careful examination of metallic precipitates.—These are 1. That thus the theory of the operation will be more perfectly understood. 2. We may discover the more useful and remarkable properties. 3. A foundation is thereby laid for essaying in the moist way, from the bare knowledge of the weights. " It may be objected (says he), that the doctrine of the weights is very fallacious; that they vary in different precipitates; that by imperfect precipitation something remains in the liquor; and that sometimes extraneous matters remain in them. All this is true; but if the mode of operation be the same, the results of the experiments will be equally constant. Thus, let us suppose that a certain quantity of metal *a*, precipitated in a certain manner, makes a weight *b*; if that same manner be exactly employed, we may fairly conclude, that a quantity of precipitate *nb*, occurring in any case, is correspondent to a quantity of perfect metal *na*; though, in the fundamental experiment, the precipitation is either incomplete, or some extraneous matter may be present. 4. The nature of metals is thus illustrated. Platina, nickel, cobalt, and manganese, are supposed by some to derive their origin from a mixture of other metals. But if iron necessarily enters into the composition of platina, when the latter is dissolved in aqua regia, it ought to yield a Prussian blue on the addition of phlogisticated alkali; which indeed is the case when common platina is employed, but not with that which is well depurated.

254 Platina is not composed partly of iron;

In like manner, if iron, adhering very obstinately to nickel, formed a great part of the latter, the precipitates obtained from it by alkalies could not differ from martial precipitates so much as they do in colour, weight, and other properties.

255 Nor regulus of nickel;

The same holds true of cobalt and manganese.

256 Cobalt or manganese

257 Quantity of precipitate obtained from manganese by phlogisticated alkali.

The regulus obtained from the latter contains about 0.08 of iron, which affects the mixture in the following manner. An hundred pounds dissolved in an acid menstruum, yields, by treatment with phlogisticated alkali, a powder consisting partly of blue, partly of brownish yellow particles, equal in weight to 150 pounds; but eight pounds of iron yield 48 of Prussian blue, nearly $\frac{1}{3}$ of the whole mass of precipitate: whence it follows, that 100 parts of pure manganese yield to phlogisticated alkali scarcely 111; *i. e.* nearly six times less than an equal weight of iron.

258 Metals contain different quantities of phlogiston.

" Lastly, by this method of examining precipitates, it may perhaps be possible to determine the unequal quantities of phlogiston in different metals; for a given weight of precipitating metal does not yield an equal quantity of precipitate: thus, for instance, copper is able to precipitate from nitrous acid four times its weight of silver."

259 Table of different precipitates.

| 100 parts of | Precipitated by | Yielded dry precip. |
|---|---|---|
| Gold, | aerated mineral alkali - | 106 |
| ——— | caustic - - | 110 |
| ——— | phlogisticated - | — |
| ——— | martial vitriol - | 100 |
| Platina, | aerated mineral alkali - | 34 |
| ——— | caustic - - | 36 |
| ——— | phlogisticated - | — |
| Silver, | aerated mineral alkali - | 129 |
| ——— | caustic - - | 112 |
| ——— | phlogisticated - | 145 |
| ——— | salited - - | 133 |
| ——— | vitriolated - | 134 |
| Mercury, | aerated mineral alkali - | 110 |
| ——— | caustic - - | 104 |
| ——— | phlogisticated - | — |
| ——— | vitriolated - - | 119 |
| Lead, | aerated mineral alkali - | 132 |
| ——— | caustic - - | 116 |
| ——— | phlogisticated - | — |
| ——— | vitriolated. - - | 143 |
| Copper, | aerated mineral alkali - | 194 |
| ——— | caustic - - | 158 |
| ——— | phlogisticated - | 530 |
| Iron, | aerated mineral alkali | 225 |
| ——— | caustic - - | 170 |
| ——— | phlogisticated - | 590 |
| Tin, | aerated mineral alkali - | 131 |
| ——— | caustic - - | 130 |
| ——— | phlogisticated - | 250 |
| Bismuth, | aerated mineral alkali - | 130 |
| ——— | caustic - - | 125 |
| ——— | phlogisticated - | 180 |
| ——— | pure water - | 113 |
| Nickel, | aerated mineral alkali - | 135 |
| ——— | caustic - - | 128 |
| ——— | phlogisticated - | 250 |
| Arsenic, | aerated mineral alkali - - | — |

Arsenic,

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| 100 parts of | Precipitated by | Yielded dry precip. |
|---|---|---|
| Arsenic, | caustic | — |
| | phlogisticated | 180 |
| Cobalt, | aerated mineral alkali | 160 |
| | caustic | 140 |
| | phlogisticated | 142 |
| Zinc, | aerated mineral alkali | 193 |
| | caustic | 161 |
| | phlogisticated | 495 |
| Antimony | aerated mineral alkali | 140 |
| | caustic | 138 |
| | phlogisticated | 138 |
| Mang. | aerated mineral alkali | 180 |
| | caustic | 168 |
| | phlogisticated | 150 |

260
Kirwan's definition of chemical attraction.

Mr Kirwan has made a great number of experiments on the attractive powers of the mineral acids to various substances, and greatly illustrated the operations of both solution and precipitation. Chemical attraction, he observes, "is that power by which the invisible particles of different bodies intermix and unite with each other so intimately, as to be inseparable by mere mechanical means." Thus it differs from the attraction of cohesion, as well as from that of magnetism and electricity, as not acting with the indifference observed to take place in these powers, but causing a body already united to another to quit that and unite with a third; whence it is called *elective* attraction. Hence attraction of cohesion often takes place betwixt bodies that have no chemical attraction for each other; as for instance, bismuth and regulus of cobalt, which cannot be made to unite together by fusion, though they cohere with each other so strongly, that they cannot be separated but by the blow of a hammer.

261
Difference betwixt chemical attraction and that of cohesion.

262
Geoffroy's rule for determining the degree of chemical attraction.

To determine the degrees of attraction betwixt different substances, M. Geoffroy laid it down as a general rule, that when two substances are united, and either quits the other to unite with a third, that which thus unites to the third must be said to have a greater affinity to it than to the substance it has quitted. In many cases, however, the seemingly single decomposition is in truth a double one. Thus, when the vitriolic acid expels the air from a fixed alkali, it does not necessarily follow, that the acid is more attracted by the alkali than the fixed air; for here though the latter resigns its place to the acid, yet the acid gives out its fire to the air; whence a decomposition might take place, even though the attractive powers of both the vitriolic and aerial acid to the alkali were equal.

263
Chemical decompositions, tho' seemingly single are often double.

264
Force of the attractive powers to be determined by numbers.

To attain to any certainty in this matter, therefore, it is necessary to determine the quantity and force of each of the attractive powers, and denote it by numbers. The necessity of this has been observed by Mr Morveau and Mr Wenzel, who have both proposed methods for answering the purpose; but Mr Kirwan has showed that both are defective: and he tells us, that the discovery of the quantity of real acid in each of the mineral acid liquors, with the proportion of real acid taken up by a given quantity of each basis at the point of saturation, led him unexpectedly to what seems the true method of investigating the quantity of attraction which each acid bears to the several bases to which it is capable of uniting: "for it was impossible (says he) not to perceive, 1. That the quantity of real acid necessary to saturate a given weight of each basis is inversely as the affinity of each basis to such acid. 2. That the quantity of each basis requisite to saturate a given quantity of each acid is directly as the affinity of such acid to each basis. Thus 100 grains of each of the acids require for their saturation a greater quantity of fixed alkali than of calcareous earths, more of this earth than of volatile alkali, more of this alkali than of magnesia, and more of magnesia than of earth of alum.

265
True method of investigating the quantity of attraction each of the acids has for its different bases.

"If an acid be united to less of any basis than is requisite for its saturation, its affinity to the deficient part of its basis is as the ratio which that deficient part bears to the whole of what the acid can saturate. Thus, if 100 grains of vitriolic acid, which can saturate 110 of calcareous earth, be united only to 55, its affinity to the deficient 55 parts should be estimated one half of its whole affinity; but its affinity to the retained part is as its whole affinity."

266
Method of explaining the decompositions effected by acids alone.

To explain the decompositions in which these acids are concerned, we must consider, first, the powers which resist any decomposition, and tend to keep the bodies in their present state; and, secondly, the powers which tend to effect a decomposition and new union; the former our author calls *quiescent affinities*, the latter *divellent*. A decomposition will therefore always take place when the sum of the divellent affinities is greater than the quiescent; and, on the contrary, no decomposition will happen when the sum of the quiescent affinities is greater than that of the divellent. All we have to do therefore is to compare the sums of each of these powers. The method our author takes to compare the affinities together is by the following table; in which the quantity of alkali, earth, &c. saturated by 100 grains of each of the mineral acids, is stated.

267
Quiescent and divellent affinities.

268
Quantity of acid taken up by various bases.

| | Veg. fixed alkali. | Mineral alkali. | Calcar. earth. | Vol. alk. | Magnesia. | Earth of alum. |
|---|---|---|---|---|---|---|
| Vitriolic acid | 215 | 165 | 110 | 90 | 80 | 75 |
| Nitrous acid | 215 | 165 | 96 | 87 | 75 | 65 |
| Marine acid | 215 | 158 | 89 | 79 | 71 | 55 |

These numbers he considers as adequate expressions of the quanity of each of the affinities. Thus the affinity of the vitriolic acid to fixed vegetable alkali is to the affinity with which it adheres to calcareous earth as 215 to 110; and to that which the nitrous acid bears to calcareous earth as 215 to 96, &c. Hence we sum up the powers of affinity betwixt any number of different substances, and account for their decompositions, as in the following example of the double decomposition, which takes place when a solution of vitriolated tartar and solution of lime or chalk in nitrous acid are mixed together.

269
Expressive of the quantity of attraction they have for each of these bases.

270
Decomposition of vitriolated tartar by solution of calcareous earth explained.

| *Quiescent Affinities.* | | *Divellent Affinities.* | |
|---|---|---|---|
| Vitriolic acid to vegetable fixed alkali, | 215 | Vitriolic acid to calcareous earth, | 110 |
| Nitrous acid to calcareous earth, | 96 | Nitrous acid to vegetable alkali, | 215 |
| Sum of quiescent affinities | 311 | Sum of divellent affinities | 325 |

Hence we see that a double decomposition must ensue. The same will be produced, if instead of vitriolated tartar we make use of Glauber's salt; for the sum of the

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the quiescent affinities is 261, of the divellent 275; with vitriolic ammoniac the sum of the quiescent is 186, of the divellent 195, &c. In mixing vitriolated tartar with solution of magnesia in nitrous or marine acids, a double decomposition takes place though invisibly, as the vitriolic Epsom salt is very soluble in water, and therefore cannot be precipitated like selenite. In the former case the sum of the quiescent powers is 290, of the divellent 295; in the second 286 and 295.

271 Coincidence of the above table with experience.

Other decompositions take place in the same manner; and from all the facts which our author had occasion to observe, he concludes, that the quantity of each affinity, as determined in the above table, coincides exactly with experience; and that these decompositions are perfectly consistent with the superior affinity which has been hitherto observed in the vitriolic and nitrous acids with fixed alkalies over the calcareous earths; nor do they infringe in the least the known laws of affinity, as has been insinuated by some chemists.

272 Mistake of Dr Crell corrected.

One fact only, mentioned in Dr Crell's Journal, seems to be repugnant to what is here advanced; and that is, that if solutions of one part of alum and two of common salt be mixed together, evaporated, and set to crystallize, a Glauber's salt will be formed; though, in this case, the sum of the quiescent affinities is 233, and that of the divellent only 223. Mr Kirwan repeated this experiment without success; and Dr Crell himself owns that it will not succeed but in the most intense cold. If it does succeed at all, he says the decomposition must arise from a large excess of acid in the alum, which acted upon and decomposed the common salt: and this explanation is confirmed by the small proportion of Glauber's salt said to be obtained by this process; for from 30lb. of common salt and 16 of alum, only 15 lb. of Glauber's salt were produced; whereas, if the whole of the alum had been decomposed, there should have been formed, according to Mr Kirwan's computation of the quantity of acid in the different salts, 29½lb, or, according to Mr Bergman's, 22lb. of Glauber's salt.

273 Formation of triple and quadruple salts.

In some cases, the neutral salts have a power of uniting, without any decomposition, or with only a very small one, to a third substance; thus forming triple salts, and sometimes quadruple; which often causes anomalies that have not yet been sufficiently investigated.

274 Volatile alkalies particularly form salts of this kind.

Volatile alkalies in particular are possessed of the power of uniting with neutral salts in this manner. Hence they seem to precipitate magnesia from Epsom salt, even when perfectly caustic; but this is owing to their combination with that salt, and forming a triple one, which is insoluble in water.

275 Vitriolic salts decomposed by the nitrous and marine acids.

It seems extraordinary that, according to Mr Kirwan's table, the three mineral acids should have the same affinity to vegetable fixed alkalies, when it is well known that the vitriolic will expel either of the other two from an alkaline basis. In explication of this, Mr Kirwan observes, that nitre is decomposed by the marine acid; and that Glauber's salt and vitriolic ammoniac are decomposed by that of nitre; and that these salts, as well as cubic nitre and nitrous ammoniac, are decomposed by the marine acid.

276 These decompositions supposed to arise from compound forces.

Mr Kirwan is of opinion, that these decompositions are the effect of a double affinity, or at least of compound forces. He suspected that they arose from the different capacities of the acids for elementary fire; and to determine this matter, he made the following experiments, in which the decompositions were not discovered by crystallization, but by tests.

277 Experiments to determine this by the various degrees of heat excited by mixtures.

1. Having procured a quantity of each of the three mineral acids containing the same proportion of real acid, and reduced them to the temperature of 68° of Fahrenheit, 100 grains of vitriolic acid, containing 26.6 of real acid, was projected upon 480 grains of oil of tartar at the same temperature, by which the thermometer was raised to 138°.

2. An hundred grains of spirit of nitre, containing also 26.6, projected on 480 grains of oil of tartar, produced only 120° of heat.

3. An hundred grains of spirit of salt, the specific gravity of which was 1220, and which contained the usual proportion of real acid, raised the thermometer from 69 to 129.

278 Vitriolic acid contains more fire than the nitrous and marine.

"Hence (says he) it follows, that the vitriolic acid contains more specific fire, or at least gives out more by uniting with fixed alkalies, than either the nitrous or marine; and therefore when the vitriolic acid comes in contact with either nitre or salt of Sylvius, its fire passes into these acids, which are thereby rarefied to a great degree, and are thus expelled from their alkaline basis, which is then seized on by the vitriolic."—

279 Difficulty in the theory.

On this, however, it is obvious to remark, that, according to Mr Kirwan's explanation, the marine acid, as giving out more specific heat, ought to expel the nitrous from an alkaline basis; which, however, is not the case. Something else, therefore, besides the mere quantity of specific heat, must here be taken into consideration. Mr Kirwan, however, goes on to prove the truth of his theory by the following experiments.

280 On the expulsion of the nitrous acid by the vitriolic diluted.

4. To 400 grains of vitriolic acid, whose specific gravity was 1.362, sixty grains of nitre were added; on which the thermometer fell from 68° to 60°. During the time of this descent, the nitrous acid was not expelled; for some filings of copper, put into the mixture, were not acted upon in the least; but in five minutes afterwards they visibly effervesced, which showed that the nitrous acid began to be expelled; for the vitriolic acid does not act upon copper but by a boiling heat.

281 By the same acid concentrated.

5. Sixty grains of nitre were put to 400 of oil of vitriol, whose specific gravity was 1.870; the thermometer instantly rose from 68° to 105°, and the nitrous acid was expelled in a visible fume.—"These experiments (says Mr Kirwan) prove, 1. That neutral salts are not decomposed by mere solution in an acid different from their own. 2. That the nitrous acid, being converted into vapour, had imbibed a large quantity of fire.

282 With a small quantity of diluted vitriolic acid.

But as the vitriolic acid, in both these experiments, was used in much larger quantity than was necessary to saturate the alkali of the nitre, sixty grains of the latter were put into 64 of the abovementioned dilute spirit of vitriol, which contained the same quantity of real vitriolic acid that the 60 grains of nitre did of the nitrous; with the addition of 40 grains of water and a few copper-filings. In less than two hours the copper was acted upon, and consequently the nitrous acid was expelled.

283 On the expulsion of marine acid by the concentrated vitriolic.

6. To 400 grains of oil of vitriol, of the specific gravity of 1.870, 100 grains of common salt were added. An effervescence immediately ensued,

and

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and the marine acid rose in white vapours. A thermometer held in the liquor rose only 4 degrees, but in the froth it ascended to 10°, and fell again upon being replaced in the liquor. Hence Mr Kirwan concludes, that the vitriolic acid gives out its fire to the marine; and that this latter received more than it could absorb even in the state of vapour, and therefore communicated heat to the contiguous liquor. It appears to him also, that the nitrous and marine acids receive fire from the vitriolic, and are thrown into a vaporous state, or at least rarefied to such a degree as to be expelled from their alkaline basis, though their affinity with that basis may be equally strong with the vitriolic.

284 Both the nitrous and marine acids receive fire from the vitriolic during their expulsion.

285 On the decomposition of vitriolated tartar by nitrous acid.

7. To ascertain the manner in which vitriolated tartar and Glauber's salt are decomposed by spirit of nitre, 60 grains of powdered tartar of vitriol were put into 400 of nitrous acid, whose specific gravity was 1.355, and which contained about 105 grains of real acid. The thermometer was not affected by the mixture; but in 24 hours the vitriolic acid was in part disengaged, as appeared by the acid mixture acting upon regulus of antimony, which neither pure vitriolic nor pure nitrous acid will do by themselves. On putting the same quantity of vitriolated tartar into 400 grains of spirit of nitre whose specific gravity was 1.478°, the thermometer rose from 67° to 79°: the vitriolated tartar was quickly dissolved, and the regulus of antimony showed that the vitriolic acid, was disengaged. Hence it appeared that the nitrous acid, having the same affinity with the basis of vitriolated tartar as the vitriolic, but giving out, during the solution, more fire than was necessary to perform the solution, the vitriolic, receiving this fire, was disengaged: for as it cannot unite to alkalies without giving out fire; so when it receives back that fire, it must quit them. The reason why the nitrous acid, which specifically contains less fire than the vitriolic, gives out so much is, that its quantity in both these experiments is far greater than that of the vitriolic; it being in the first as 105 to 17, and in the last as 158 to 17.

286 Acids unite to alkalies by giving out fire, and quit them by receiving it.

287 Vitriolated tartar cannot be decomposed by diluted nitrous acid.

8. To 60 grains of spirit of nitre, whose specific gravity was 1.355, Mr Kirwan added 1000 grains of water; and into this dilute acid put 60 grains of vitriolated tartar, containing exactly the same quantity of real acid that the 60 grains of nitrous acid did. In eight days the vitriolated tartar was almost entirely dissolved, and without any sign of its decomposition; and no nitre was found upon evaporating the liquor. Hence he concludes, that the nitrous acid can never decompose vitriolated tartar, without the assistance of heat, but when its quantity is so great that it contains considerably more fire, and by the act of solution is determined to give out this fire. This salt is also decomposed, in similar circumstances, by the marine acid; though still more slowly and with more difficulty than by the nitrous, as appears by the following experiments.

288 Decomposition of vitriolated tartar by marine acid.

9. Into 400 grains of spirit of salt, whose specific gravity was 1.220, were put 60 grains of vitriolated tartar. The thermometer was not affected in the least, and the salt dissolved very slowly. Some pulverized bismuth was added to try whether the vitriolic acid was disengaged; and in 12 hours part of it was dissolved, so that it could not be precipitated by water. This showed, that part of the vitriolic acid was dislodged; for this semi-metal cannot be kept in solution when much diluted with water, excepting by a mixture of marine and vitriolic acids.

289 Requisites for the success of this experiment.

In this experiment the quantity of marine acid was much greater than that of the vitriolic; and therefore it was capable of dislodging it. This circumstance alone, however, is not sufficient; the acid must be disposed to give out by solution that quantity of fire which it is necessary the vitriolic should receive in order to its quitting the basis to which it is united; and therefore when Mr Cornette added two ounces of spirit of salt to half an ounce of vitriolated tartar already dissolved, in water, no decomposition took place. The reason of this was, that as the vitriolated tartar was already dissolved, no cold nor heat was generated by the mixture; and therefore the spirit of salt could not give out any fire. Glauber's salt is more easily decomposed by marine acid then vitriolated tartar, on account of its being more easily soluble in spirit of salt; and likewise because its alkaline basis takes up an equal quantity of both acids: consequently the marine gives out more fire in uniting to the basis of Glauber's salt than on being united to that of vitriolated tartar. Vitriolic ammoniac is also decomposed by means of marine acid; but in all these cases, the quantity of marine acid must greatly exceed that of the vitriolic contained in the salt to be decomposed; and it must be remarked, that according to the observations of Mr Bergman, the decomposition of Glauber's salt or vitriolic ammoniac by this acid is never complete.

290 Vitriolated tartar dissolved in water cannot be decomposed by marine acid, and why.

291 Decomposition of vitriolic ammoniac and Glauber's salt by marine acid never complete.

292 Nitrous salts decomposed by marine acid.

On the same principles the marine acid decomposes salts which have the nitrous acid for their basis. Mr Cornette found, that cubic nitre was more easily decomposed by it than that which has vegetable alkali for its basis. Accordingly, during the solution of prismatic nitre, only three degrees of cold were produced; but six by the solution of cubic nitre; which shows that the spirit of salt gave out more fire in the latter case than in the former; and its quantity must always be greater than that of the nitrous acid contained in the mineral alkaline basis; because this basis requires for its saturation more of the marine than of the nitrous acid. The nitrous acid, however, in its turn decomposes salt of Sylvius and common salt; but it must always be in greater quantity than the marine to produce that effect.

293 Marine salts decomposed by the nitrous acid.

10. Sixty grains of common salt being added to 400 of colourless spirit of nitre, whose specific gravity was 1.478, the mixture quickly effervesced and grew red, yet the thermometer rose but two degrees; which showed that the marine acid had absorbed the greater part of the first given out by that of nitre; the decomposition was likewise hastened by the superior affinity of the nitrous acid to the alkaline basis of the sea-salt: hence the decomposition of sea-salt by means of nitre takes place without any solution; but spirit of salt will not decompose cubic nitre until it has first dissolved it. This mutual expulsion of the nitrous and marine acids by each other, is the reason why aqua-regia may be made by adding nitre or nitrous ammoniac to spirit of salt, as well as by adding common salt or sal ammoniac to spirit of nitre.

Selenite cannot be decomposed either by nitrous or marine

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294 Selenites cannot be decomposed by marine acid.

295 Why the vitriolic acid assumes on evaporation the bases it had lost.

marine acid; because it cannot be dissolved in either without the assistance of foreign heat. It must likewise be observed, that in all decompositions of this kind, when the liquor has been evaporated to a certain degree, the vitriolic acid expels in its turn the nitrous or marine acid to which it had already yielded its basis. The reason of this is, that the free part of the weaker acids being evaporated, the neutral salts begin to crystallize, and then giving out heat, the vitriolic absorbs it; and thus reacting upon them expels them from the alkali or earth to which they are united.

296 Difficulties in determining the attractive powers of the acids to metals.

Mr Kirwan found much more difficulty in determining the attractive powers of the different acids to the metals than to alkaline salts or earths. Some of the difficulties met with in this case arose from the nature of metallic substances themselves. Their calces when formed by fire always contain a quantity of air, which cannot be extracted from them without great difficulty, and is very soon re-absorbed; and if formed by solution, they as constantly retain a part of their solvent or precipitant; so that the precise weight of the metalline part can scarce be discovered. Our author, therefore, and because metallic calces are generally insoluble in acids, chose to have the metals in their perfect state: and even here they must lose a part of their phlogiston before they can be dissolved in acids, and a considerable part remains in the solution of the acid and calx; which last quantity he endeavoured to determine.

297 Metallic salts insoluble in water without an excess of acids.

A new difficulty now occurred, arising from the impossibility of finding the real quantity of acid necessary to saturate the metal, for all metallic solutions contain an excess of acid: the reason of which is, that the salts formed by a due proportion of acid and calx are insoluble in water without a further quantity of acid; and in some cases this quantity, and even its proportion to the aqueous part of the liquor, must be very considerable, as in solutions of bismuth. It was in vain attempted to deprive those solutions of their excess of acid by means of caustic alkalies and lime-water; for when deprived of only part of it, many of the metals were precipitated, and all of them would be so if deprived of the whole. As the solution of silver, however, can be very much saturated, Mr Kirwan began with it and found that 657 grains of this solution contained 100 grains of silver, and 31.38 grains of real acid, after making the proper allowance for the quantity dissipated in nitrous air. Nine grains of this solution tinged an equal quantity of solution of litmus as red as $\frac{8}{10}$ of a grain of real acid of spirit of nitre would have done; whence our author concluded that 9 grains of his solution of silver contained an excess of $\frac{8}{10}$ of a grain of real silver: according to which calculation, the whole quantity ought to have contained 5.6 grains; which deducted from 31.38, leaves 25.78 grains for the quantity of acid saturated by 100 grains of silver.

As the vitriolic solutions of tin, bismuth, regulus of antimony, nickel, and regulus of arsenic, contain a large excess of acid, Mr Kirwan saturated part of it with caustic volatile alkali before he tried them with the infusion of litmus; and the same method was used with solutions of iron, lead, tin, and regulus of antimony in the nitrous and marine acids. The proportion of vitriolic and marine acid taken up by lead, silver, and mercury, were determined by computing the quantity of real acid necessary to precipitate these metals from their solutions in the nitrous acid; which seemed to be the most exact method of determining this point. The result of all the experiments was, that 100 grains of each of these acids take up at the point of saturation of each metallic substance, dephlogisticated such a degree as is necessary for its solution in each acid, the quantities marked in the following table.

298 Quantities of the different metals taken up by acid.

| 100 grains of | Iron. | Copper. | Tin. | Lead. | Silver. | Merc. | Zinc. | Bismuth. | Nickel. | Cobalt. | Reg. of ant. | Reg. of arsen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vitriolic acid | 270 | 260 | 138 | 412 | 390 | 432 | 318 | 250<br>310 | 320 | 360 | 200 | 260 |
| Nitrous acid | 255 | 255 | 120 | 365 | 375 | 416 | 304 | 290 | 300 | 350 | 194 | 220 |
| Marine acid | 265 | 265 | 130 | 400 | 420 | 438 | 312 | 250<br>320 | 275<br>310 | 370 | 198 | 290 |

299 Metals have a greater affinity with acids than alkalies.

300 Why alkalies precipitate the metals.

Though from this table, compared with the former, we might suppose that metals, having a greater attraction for acids than alkalies, could not be precipitated by them, yet Mr Kirwan observes, that the common tables, which postpone metallic substances to alkaline salts, are in reality just, though there can scarce be any room to doubt that almost all metallic substances have a greater affinity with acids than alkalies have. The common tables, he says, are tables of precipitation rather than of affinity, as far as they relate to metallic substances. These precipitations, however, are constantly the result of a double affinity and decomposition; the precipitating metal yielding its phlogiston to the precipitated one, while the precipitated metal yields its acid to the other. Thus, though copper in its metallic form precipitates silver and mercury from the nitrous acid, yet the calx will precipitate neither.

301 Nitrous acid attracts silver more than fixed alkali.

The superior attraction the nitrous acid has to silver rather than fixed alkali, appears from the following experiment. If a solution of silver in nitrous acid be poured into a mixed solution of alkali and sea-salt, the silver will be precipitated by the sea-salt into a luna cornea, and not by the loose alkali contained in the liquor. "Now (says Mr Kirwan), if the nitrous acid had a greater affinity to the free alkali than to the silver, it is evident that the silver would be precipitated pure, and not in the state of luna cornea; but from its being precipitated in this state, it is plain, that the precipitation was not accomplished by a single but by a double affinity. Hence also the marine acid appears to have a greater attraction to silver than the nitrous has to fixed alkalies. The result is similar when we make use of solutions of lead or mercury in the nitrous acid. Mr Bayen has also shown, that vitriol of lead and corrosive sublimate mercury cannot be deprived of more than half their acid, even by caustic fixed alkalies.

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With regard to lead, if perfectly dry ſalt be projected on this metal heated to ignition, the common ſalt will be decompoſed, and plumbum corneum formed. Nor

302 Sea-ſalt decompoſed in various ways by means of lead.

can we attribute this to the volatilization of the alkali by heat; for the alkali is as fixed as the lead, and muſt therefore be cauſed by the ſuperior attraction which the calx of this metal, even when dephlogiſticated, has for the marine acid. Mr Scheele informs us, that if a ſolution of common ſalt be digeſted with litharge, the common ſalt will be decompoſed, and a cauſtic alkali produced. It may alſo be decompoſed ſimply by letting its ſolution paſs ſlowly through a funnel filled with litharge; and the ſame thing happens to a ſolution of calcareous earth in marine acid; which ſhows that the decompoſition takes place merely by the ſuperior degree of attraction betwixt the acid and metallic calx (A).

303 Acids attract metallic earth more ſtrongly than volatile alkali.

That acids have a greater attraction for metallic earths than volatile alkalies, is ſtill more evident. Luna cornea is ſoluble in volatile alkalies; but if this ſolution be triturated with four times its weight of quickſilver, a *mercurius dulcis*, and not ſal ammoniac, is formed. The reaſon why alkalies and earths precipitate all metallic ſolutions is, that the metals are held in ſolution by an exceſs of acid. Even if the alkaline and earthy ſubſtance did no more than abſorb this exceſs of acid, a precipitation muſt neceſſarily enſue; but they not only take up this ſuperabundant acid, but alſo the greater part of that which is neceſſary to ſaturate the metallic earth. This they are enabled to do by means of a double affinity; for during the ſolution of metals, only a ſmall part of the phlogiſton, comparatively ſpeaking, eſcapes, the remainder being retained by the compound of acid and calx. When therefore an alkali or earth is added to ſuch a ſolution, the phlogiſton quits the acid, and joins with the calx, while the greater part of the acid

304 Why the metallic earths ſeldom decompoſe ſalts having an earth or alkali for their baſis.

reunites to the precipitate. Notwithſtanding this great affinity, however, of metallic earths to acids, there are but few inſtances of their decompoſing thoſe ſalts which have an alkali, or an earth for their baſis, by reaſon of the inability of the acids, while combined with theſe baſes, and thereby deprived of a great part of their ſpecific fire, to volatilize the phlogiſton combined with the metallic earths, which muſt neceſſarily be expelled before an acid can combine with them: and as to the metallic calces, they are generally combined with fixed air, which muſt alſo be partly expelled; but ammoniacal ſalts (containing much more fire, for they abſorb it during their formation) for that reaſon act much more powerfully on metals. Allowing then the affinities of the mineral acids with metallic ſubſtances to be as above, all double decompoſitions, in which only ſalts containing theſe acids united to alkaline, terrene, or

305 Decompoſition of vitriolated tartar by ſolution of ſilver explained;

metallic baſes, are concerned, admit of an eaſy explanation; nay, ſays Mr Kirwan, I am bold to ſay, they cannot otherwiſe be explained. Thus, if a ſolution of tartar vitriolate, and of ſilver in the nitrous acid, be mixed in proper proportion, nitre and vitriol of ſilver will be formed; and this latter for the moſt part precipitated.

| *Quieſcent Affinities* | | *Divellent Affinities.* | |
|---|---|---|---|
| Nitrous acid to ſilver, | 375 | Nitrous acid to vegetable alkali, | 215 |
| Vitriolic acid to vegetable alkali, | 215 | Vitriolic acid to ſilver, | 390 |
| | 590 | | 605 |

306 And of Glauber's ſalt, vitriolic ammoniac, &c.

Thus alſo, if, inſtead of a ſolution of tartar vitriolate, that of Glauber's ſalt, or of vitriolic ſal ammoniac, ſelenite, Epſom ſalt, or alum, be uſed, the balance is conſtantly in favour of the divellent powers; and a precipitation is the conſequence, though but ſlight when ſelenite or alum are uſed.

307 In what caſes ſolution of ſilver is precipitated by other metals.

Solution of ſilver is alſo precipitated by the vitriolic ſolutions of iron, copper, tin, and probably by many other ſolutions of metals in the vitriolic acid: for this reaſon, among others undoubtedly, that they contain an exceſs of acid: but if a ſaturated ſolution of ſilver be mixed with a very ſaturated ſolution of lead or mercury in the vitriolic acid, the ſilver will not be precipitated; and in both caſes the balance is in favour of the quieſcent affinities.

308 Conſtantly decompoſed by marine ſalts;

All the marine neutral ſalts, whether the baſis be alkaline, terrene, or metallic, decompoſe the nitrous ſolution of ſilver; and theſe decompoſitions are conſtantly indicated by the balance of affinities already deſcribed. The ſame thing alſo takes place with ſolution of ſilver in the vitriolic acid, as is indicated alſo by the ſame

309 As alſo ſolution of lead.

table. The nitrous ſolution of lead is alſo decompoſed, and the metal for the moſt part precipitated, unleſs the ſolution be very dilute in the form of vitriol of lead, by all the neutral ſalts containing either the vitriolic or marine acid, excepting only the combination of ſilver with marine acid, which precipitates it in no other way than by its exceſs of acid.

310 Solution of lead in marine acid decompoſed by vitriolic ſalts;

Solution of lead in marine acid is decompoſed by all the neutral ſalts containing the vitriolic acid, excepting only ſelenite and ſolution of nickel in oil of vitriol. Theſe can only precipitate it by virtue of an exceſs of acid.

Nitrous ſolution of mercury is decompoſed by all the neutral ſalts containing the vitriolic acid, except vitriol of lead, which only decompoſes it by an exceſs of acid.

311 Alſo nitrous ſolutions of mercury;

All the ſalts containing marine acid decompoſe the nitrous ſolution of mercury, excepting the combinations of marine acid with ſilver and lead, which decompoſe it by exceſs of acid.

312 And by the ſalts containing marine acid.

Theſe ſalts alſo decompoſe vitriol of mercury, tho' a precipitation does not always appear, owing, as Mr Kirwan ſuppoſes, to the facility with which a ſmall quantity of the marine ſalt of mercury is ſoluble in an exceſs of acid. Marine ſalt of ſilver, however, decompoſes vitriol

313 Vitriol of mercury decompoſed by marine acid.

of mercury only through its exceſs of acid. Hence we ſee why luna cornea can never be reduced by fixed alkalies without loſs; and were it not that the action of the alkali is aſſiſted by heat, it never could be reduced by them at all.

314 Why luna cornea cannot be reduced without loſs by alkaline ſalts.

When oil of vitriol is mixed with a ſolution of corroſive ſublimate, a precipitate falls: but this, as Mr Bergman remarks, does not proceed from a decompoſition



(A) Theſe experiments have been repeated by many other chemiſts without ſucceſs; and Mr Wiegleb informs, that none of thoſe who have attempted to decompoſe ſea-ſalt by means of lead, ever found their methods anſwer the purpoſe.

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sition of the mercurial salt, but from an abstraction of the water necessary to keep the sublimate dissolved.

315 Precipitation of corrosive mercury by oil of vitriol explained.

316 Table of the affinities to the different metals explained.

In the foregoing table two different affinities are assigned to the vitriolic acid with regard to bismuth and nickel; one showing the affinity which these acids bear to the metals when dephlogisticated only by solution in the acids; the other that which the acids bear to them when more dephlogisticated, as when they are dissolved in the nitrous acid. On the other hand, all the acids have less affinity with the calces of iron, zinc, tin, and antimony, when they are dephlogisticated to a certain degree; but our author found himself unable to give any certain criteria of this dephlogistication.

317 Of the quantity of phlogiston contained in the different metals.

318 Method of calculating this quantity exemplified in regulus of arsenic.

The most difficult point to be settled was the precipitation of metals by each other from the mineral acids. To determine this it was necessary to find the quantity of phlogiston in each of them, not only in their natural state, but according to their various degrees of dephlogistication by each of the acids. The substance he chose for determining the absolute quantity of phlogiston in a metallic substance was regulus of arsenic. An hundred grains of this semimetal dissolved in dilute nitrous acid yielded 102.4 cubic inches of nitrous air; which, according to his calculations on that subject, contain 6.86 grains of phlogiston: and hence he concluded that 100 grains of regulus of arsenic contain 6.86 grains of phlogiston. From this experiment, three times repeated with the same success, our author proceeded to form, by calculation, a table of the absolute quantity of phlogiston contained in metals, the relative quantity having been computed by Mr Bergman and his calculations adopted by our author. These quantities are as follow.

319 Table of the quantities of phlogiston in different metals.

| | | Relative Quantity. | Absolute Quantity |
|---|---|---|---|
| 100 grains | Gold | 394 | 24.82 |
| | Copper | 312 | 19.65 |
| | Cobalt | 270 | 17.01 |
| | Iron | 233 | 14.67 |
| | Zinc | 182 | 11.46 |
| | Nickel | 156 | 9.82 |
| | Regulus of antimony | 120 | 7.56 |
| | Tin | 114 | 7.18 |
| | Regulus of arsenic | 109 | 6.86 |
| | Silver | 100 | 6.30 |
| | Mercury | 74 | 4.56 |
| | Bismuth | 57 | 3.59 |
| | Lead | 43 | 2.70 |

320 Experiments explaining the reduction of silver *per se*.

This point he likewise endeavoured to ascertain by other experiments. As silver loses a certain quantity of phlogiston, which escapes and separates from it during its solution in nitrous acid, he concluded, that if the solution was exposed to nothing from which it could reobtain phlogiston, and this was distilled to dryness, and entirely separated from the acid, as much silver should remain unreduced as corresponded with the quantity of phlogiston lost by it; and if this quantity corresponded with that in the above table, he then had good reason to conclude that the table was just.

For this purpose 120 grains of standard silver were dissolved in dephlogisticated nitrous acid diluted with water, and he obtained from it 24 cubic inches of nitrous air. This solution was gently evaporated to dryness; and he found that, during the evaporation, about a quarter of a grain of the silver had been volatilized. The dry residuum was then distilled, and kept an hour in a coated green-glass retort heated almost to a white heat. Abundance of nitrous acid passed off during the operation, and a green and white sublimate rose into the neck of the retort, some of it even passing over into the receiver. On breaking the retort, the inside was penetrated with a yellow and red tinge, and partly covered over with an exceedingly fine silver powder, which could scarcely be scraped off. The remainder of the silver was white, and perfectly free from acid, but not melted into a button. On being collected, it weighed 94 grains; consequently 26 grains had been lost either by sublimation or vitrification; but of these 26 grains 9 were copper: for 100 grains of standard silver contain 7¼ of copper, therefore only 17 grains of pure silver remained unreduced, being either volatilized or vitrified. The whole quantity of pure silver in 120 grains of standard silver amounts to 111 grains; then if 111 grains of pure silver lose 17 by being deprived of its phlogiston, 100 grains of the same should lose 15.3; and by the above table 15.3 grains of silver should contain 0.945 of a grain of phlogiston. Now, 100 grains of pure silver afford 14 cubic inches of nitrous air, which, according to our author's calculation, contain 0.938 of a grain of phlogiston; and this differs from 0.945 only by .007 of a grain. "In this experiment (says Mr Kirwan) only as much of the silver sublimed as could not regain phlogiston; the remainder regained it from the nitrous air absorbed by the solution, and by that which remained in the acid and calx. If this were not so, I do not see why the whole of the silver would not sublime."

321 Quantity of pure metal contained in standard silver.

322 Examination of Dr Priestley's experiment concerning the revival of mercury.

Dr Priestley having several times dissolved mercury in the nitrous acid, and revivified it by distilling over that acid, constantly found a considerable portion of it unreduced. To try whether that proportion corresponded with his calculation, Mr Kirwan examined Dr Priestley's experiment, *viz.* that having dissolved 17 penny-weights 13 grains (321 grains) of mercury in nitrous acid, 36 grains remained unreduced. According to Mr Kirwan's calculation 56 grains should have remained unreduced; for 100 grains of mercury afford 12 cubic inches of nitrous air; of consequence 321 grains should afford 38.52, which contain 2.58 of phlogiston: and if, as according to the table, 4.56 grains of phlogistion be necessary to metallize 100 grains of mercury, 2.58 grains will be necessary to metallize 56 grains of the same metal; and our author is satisfied from his own trials, that more than 50 grains would have remained unreduced, if dephlogisticated nitrous acid had been used in dissolving the mercury, and the solution performed with heat and a strong acid: but that which the Doctor used was of the smoking kind, and consequently contained a considerable quantity of phlogiston already, which undoubtedly contributed to revive more of the metal than would otherwise have been done. It is true, Dr Priestley afterwards revived a great part of what had originally remained unreduced; but this happened after it had been some time exposed to the free air, from which the calces of metals always attract phlogiston; as is evident in luna cornea, which blackens on being exposed to the air.

323 Why so much of the metal was revived in the Doctor's experiments.

By another experiment of Dr Priestley's, it was found

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found, that nearly five pennyweights of minium, from whence all its air was extracted, that is, about 118 grains, absorbed 40 ounce-measures, or 75.8 cubic inches of inflammable air, containing 2.65 grains of phlogiston, by which they were reduced. An hundred grains of minium, therefore, require for their reduction nearly 2.25 grains of phlogiston. In another experiment made with more care, he found, that 480 grains of minium absorbed 108 ounce-measures of inflammable air; so that, according to this, 100 grains of minium require for their reduction 1.49 grains of phlogiston; and in two succeeding experiments he found the quantity still less. On this Mr Kirwan remarks, 1. That the whole of the minium was not dephlogisticated; for it is never equally calcined, and besides much of it must have been reduced during the expulsion of its air. 2. The quantity of phlogiston in the inflammable air may have been greater, as this varies with its temperature and the weight of the atmosphere: so that on the whole these experiments confirm the results expressed in the table.

324 Of the revival of lead from minium by inflammable air.

325 Mr Kirwan's remarks on the experiments of Dr Priestley.

326 Of the attraction of metallic calces to phlogiston.

Mr Kirwan next proceeds to consider the attraction of metallic calces to phlogiston. Inflammable air, when condensed into a solid substance, he supposes not only equal, but much superior, to any metallic calx in specific gravity; and therefore, if we could find the specific gravity of any calx free both from phlogiston and fixed air, we would thus know the density which phlogiston acquires by its union with such calx. It has, however, hitherto proved impossible to procure calces in such a state; as, during their dephlogistication, they combine with fixed air or some particles of the menstruum, whence their absolute weight is increased, and their specific gravity diminished. Hence it appears, that the specific gravity of the calces differs much less from that of their respective metals, than the specific gravity which the phlogiston acquires by its union with those calces from that which it possesses in its uncombined state. Hence, instead of deducing the quantity of affinity betwixt phlogiston and metallic calces from the following proposition, that "the affinity of metallic calces to phlogiston is in a compound ratio of its quantity and density in each metal," he is obliged to deduce it from this other, that "the affinity of metallic calces to phlogiston is directly as the specific gravity of the respective metals, and inversely as the quantity of calx contained in a given weight of these metals." This latter proposition is an approximation to the former, founded on this truth, that "the larger the quantity of phlogiston in any metal is, the smaller is the quantity of calx in a given weight of that metal;" and, that "the density which the phlogiston acquires is as the specific gravity of the metal." This latter proposition, however, is not strictly true, for this density is much greater; but its defect is only sensible with regard to those metals which contain a considerable quantity of phlogiston, as gold, copper, cobalt, and iron. With regard to the rest, it is of no importance. The specific gravity of the different metals, then, being as represented in the first column of the following table, the affinity of their calces to phlogiston will be as in the second; and the third expresses the affinities in numbers homogeneous with those which express the affinities of acids with their basis.

327 Of finding the specific gravity of the different metallic calces.

328 Whence their various degrees of affinity to phlogiston may be determined.

330 Table of the proportional affinities of metallic calces to phlogiston.

| | Specific Gravity. | Proportionable Affinities. | Real Affinities of Calx to Phlogist. |
|---|---|---|---|
| Gold | 19 | 0.25 | 1041 |
| Mercury | 14 | 0.147 | 612 |
| Silver | 11.091 | 0.118 | 491 |
| Lead | 11.33 | 0.116 | 483 |
| Copper | 8.8 | 0.109 | 454 |
| Bismuth | 9.6 | 0.099 | 412 |
| Cobalt | 7.7 | 0.092 | 383 |
| Iron | 7.7 | 0.090 | 375 |
| Regulus of Arsenic | 8.31 | 0.089 | 370 |
| Zinc | 7.24 | 0.0812 | 338 |
| Tin | 7 | 0.075 | 312 |
| Regulus of Antimony | 6.86 | 0.074 | 308 |

331 Why lead is useful in cupellation.

From this table we may see why lead is useful in cupellation; namely, because it has a greater affinity with phlogiston than the calces of any of the other imperfect metals; consequently after it has lost its own phlogiston, it attracts that of the other metals with which it is mixed, and thus promotes their calcination and vitrification.

332 Quantity of phlogiston lost by metals during calcination.

The third point necessary for the explanation of the phenomena attending the solution of metals, and their precipitation by each other, is to determine the proportion of phlogiston which they lose by solution in each of the acids, and the affinity which their calces bear to the part so lost. Though our author was not able to determine this by any direct experiment, yet from various considerations he was led to believe that it was as follows:

Quantity of Phlogiston separated

| From | Iron, | Copper, | Tin, | Lead, | Silver, | Mercury, | Zinc, | Bismuth, | Cobalt, | Nickel, | Reg. of Ant. | Reg. of Arf. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By the vitriolic acid | $\frac{2}{3}$ | $\frac{8}{10}$ | $\frac{7}{10}$ | $\frac{98}{100}$ | Entire | $\frac{87}{100}$ | $\frac{85}{100}$ | $\frac{85}{100}$ | $\frac{93}{100}$ | Entire | $\frac{97}{100}$ | $\frac{86}{100}$ |
| By nitrous acid | $\frac{2}{3}$ | $\frac{81}{100}$ | $\frac{7}{10}$ | $\frac{88}{100}$ | Entire | $\frac{9}{10}$ | $\frac{99}{100}$ | $\frac{97}{100}$ | Entire | Entire | Entire | $\frac{99}{100}$ |
| By marine acid | $\frac{42}{100}$ | $\frac{57}{100}$ | $\frac{3}{10}$ | $\frac{6}{10}$ | —— | —— | $\frac{6}{10}$ | $\frac{7}{10}$ | $\frac{94}{100}$ | $\frac{8}{10}$ | $\frac{84}{100}$ | $\frac{6}{10}$ |

329 Of the affinity of calces to the deficient part of their phlogiston.

The affinity of the calces to the deficient part of their phlogiston may now be easily calculated; for they may be considered as acids, whose affinity to the deficient part of their basis is as the ratio which that part bears to the whole. Thus the affinity of iron, thoroughly deprived of its phlogiston, being 375, as it loses two thirds of its phlogiston by solution in the vitriolic acid, the affinity of iron to these is two-thirds of its whole affinity; that is, two-thirds of 375, or 250.

333 Use of these calculations and tables for knowing *à priori* the phenomena of precipitation.

Thus we may easily construct a table of the affinities of the phlogiston of different metals for their calces; and from this and that formerly given, by which the affinities of the acids to the metallic calces was expressed, we may guess what will happen on putting one metal in the solution of another. Thus if a piece of copper be put into a saturated solution of silver, the silver will be precipitated; for the balance is in favour of the divellent powers, as appears from the following calculation.

*Quiescent*

| *Quiescent Affinities.* | | *Divellent Affinities.* | |
|---|---|---|---|
| Nitrous acid to silver | 375 | Nitrous acid to copper | 255 |
| Calx of copper to phlogiston | 363 | Calx of silver to phlogiston | 491 |
| Sum of the quiescent affinities | 738 | Sum of the divellent | 746 |

334 **Of the excess of acid in solutions proper for making these experiments.**

In making these experiments the solutions must be nearly, though not entirely, saturated. If much superfluous acid be left, a large quantity of the added metal will be dissolved, before any precipitation can be made to appear; and when the solution is perfectly saturated, the attraction of the calces for one another begins to appear; a power which sometimes takes place, and which has not yet been fully investigated.

335 **Why the metals are more dephlogisticated by mutual precipitation than by direct solution.**

In this way the precipitating metals are more dephlogisticated than by direct solution in their respective menstrua; and are even dissolved by menstrua which would not otherwise affect them. The reason of this is, that their phlogiston is acted upon by two powers instead of one: and hence, though copper be directly soluble in the vitriolic acid only when in its concentrated state, and heated to a great degree;

336 **Why copper is dissolved by solution of silver, mercury, or iron.**

yet if a piece of copper be put into a solution of silver, mercury, or even iron, though dilute and cold, and exposed to the air, it will be dissolved; a circumstance which has justly excited the admiration of several eminent chemists, and which is inexplicable on any other principles than those just now laid down. From this circumstance we may see the reason why vitriol of copper, when formed by nature, always contains iron.

Mr Kirwan now proceeds to consider the solutions of metallic substances in all the different acids.

337 **Iron and zinc the only metals dissolved by vitriolic acid.**

Vitriolic acid, he observes, dissolves only iron and zinc of all the metallic substances, because its affinity to their calces is greater than that which they bear to the phlogiston they must lose before they can unite with it.

338 **Nitrous acid dissolves all metals, though it has less affinity with them than the vitriolic or marine.**

Nitrous acid has less affinity with all metallic substances than either the vitriolic or marine; yet it dissolves them all, gold, silver, and platina excepted, though it has even less affinity with them than they have with that portion of phlogiston which must be lost before they can dissolve in any acid. The reason of this is, that it unites with phlogiston, unless when in too diluted a state; and the heat produced by its union with phlogiston is sufficient to promote the solution of the metal.

339 **Why it cannot dissolve them when much concentrated.**

On the other hand, when very concentrated, it cannot dissolve them: because the acid does not then contain fire enough to throw the phlogiston into an aerial form, and reduce the solid to a liquid.

340 **In what cases the marine acid can dissolve metals, and when it cannot.**

The marine acid dephlogisticates metals less powerfully than any other. It can make no solution, or at least can operate but very slowly, without heat, in those cases where the metallic calx has a stronger affinity with that portion of the phlogiston which must be lost, than the acid: nor can it operate briskly even where the attraction is stronger, provided, the quantity of acid be small; because such a little quantity of acid does not contain fire enough to volatilize the phlogiston: and hence heat is necessary to assist the marine acid in dissolving lead. When dephlogisticated, it acts more powerfully.

It has been observed, that copper and iron mutually precipitate one another. If a piece of copper be



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341 **Why copper and iron precipitate one another.**

put into a saturated solution of iron fresh made, no precipitation will ensue for 12 hours, or even longer, if the liquor be kept close from the air; but if the liquor be exposed to the open air, the addition of volatile alkali will show, in 24 hours, that some of the copper has been dissolved, or sooner, if heat be applied, and a calx of iron is precipitated. The reason of this will be understood from the following state of the affinities.

| Quiescent. | | Divellent. | |
|---|---|---|---|
| Vitriolic acid to calx of iron | 270 | Vitriolic acid to copper | 260 |
| Copper to its phlogiston | 360 | Calx of iron to phlogiston | 250 |
| | 360 | | 510 |

In this case no decomposition can take place, because the sum of the divellent affinities is less than that of the quiescent; but in the second, when much of the phlogiston of the iron has escaped, the affinity of the calx of iron to the acid is greatly diminished, at the same time that the affinity of the calx to phlogiston is augmented. The state of the affinities may therefore be supposed as follows.

| *Quiescent.* | | *Divellent.* | |
|---|---|---|---|
| Vitriolic acid to calx of iron | 240 | Vitriolic acid to copper | 260 |
| Copper to its phlogiston | 360 | Calx of iron to phlogiston | 370 |
| | 600 | | 630 |

342 **Increase of the attraction of calx of iron to phlogiston demonstrated.**

The increase of affinity of the calx of iron to phlogiston is not a mere supposition; for if we put some fresh iron to a solution of the metal so far dephlogisticated as to refuse to crystallize, so much of the phlogiston will be regained that the impoverished solution will now yield crystals. The reason why the increased quantity of phlogiston does not enable the acid to re-act upon the metal is, because it is neither sufficiently large, nor attracted with a sufficient degree of force, to which the access of air and heat employed contribute considerably. The diminution of attraction in calces of iron for acids is evident, not only from this but many other experiments; and particularly from the necessity of adding more acid to a turbid solution of iron in order to re-establish its transparency.

343 **Calces of copper precipitate dephlogisticated solutions of iron.**

A dephlogisticated solution of iron is also precipitated by the calces of copper. The same thing happens to a solution of iron in nitrous acid; only as the acid predominates greatly in this solution, some of the copper is dissolved before any of the iron is precipitated. Copper precipitates nothing from solution of iron in the marine acid, though exposed to the open air for 24 hours.

344 **Martial vitriol procured by precipitation of copper less fit for dyeing than the common.**

Solution of copper in the vitriolic acid is instantly precipitated by iron; the reason of which is plain from the common table of affinities: and hence the foundation of the method of extracting copper, by means of iron, from some mineral waters. The precipitated solution affords a vitriol of iron, but of a paler kind than that commonly met with, and less fit for dyeing, as being more dephlogisticated: the reason of which is, that copper contains more phlogiston than iron: old iron is also used which has partly lost its phlogiston.

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giston. Hence the iron is more dephlogisticated by precipitating copper than by mere dissolution in the vitriolic acid; and hence cast iron, according to the observations of Mr Schlutter, will scarcely precipitate a solution of copper; because it contains less phlogiston than bar-iron, as Mr Bergman has informed us.

345 Solution of copper scarcely decomposed by cast iron.

Mr Kirwan always found silver easily precipitated by means of iron from its solution in nitrous acid; though Bergman had observed that a saturated solution of silver could not be thus precipitated without great difficulty, even though the solution were diluted and and an excess of acid added to it. What precipitation took place could only be accomplished by some kinds of iron. The reason of this Mr Kirwan supposes to be, that the solution, even after it is saturated, takes up some of the silver in its metallic form; which Mr Scheele has also observed to take place in quicksilver. The last portions of both these metals when dissolved in strong nitrous acid, afford no air, and consequently are not dephlogisticated. This compound of calx, therefore, and of silver in its metallic state, it may reasonably be supposed cannot be precipitated by iron, as the silver in its metallic form prevents the calx from coming into contact with the iron, and extracting the phlogiston from it; and for the same reason iron has been observed not to precipitate a solution of mercury in the nitrous acid.

346 Why a saturated solution of silver can scarce be precipitated by iron.

347 Of the precipitation of zinc and iron by one another.

Zinc cannot precipitate iron, as Mr Bergman has shown, until the solution of the latter loses part of its phlogiston. Hence we may understand why Newmann denied that iron can be precipitated by means of zinc. Mr Kirwan, however, has found, that zinc does not precipitate iron from the nitrous acid; but on the contrary, that iron precipitates zinc. In a short time the acid redissolves the zinc and lets fall the iron, owing to the calx of iron being too much dephlogisticated. Iron, however, will not precipitate zinc either from the vitriolic or marine acids. Most of the metallic substances precipitated by iron from the nitrous acid are in some measure redissolved shortly after; because the nitrous acid soon dephlogisticates the iron too much, then lets it fall, reacts on the other metals, and dissolves them.

348 Why copper sometimes cannot precipitate silver.

Dr Lewis observes, that silver is sometimes not precipitated by copper from the nitrous acid; which happens either when the acid is supersaturated with silver by taking up some in its metallic form, or when the silver is not much dephlogisticated. In this case, the remedy is to heat the solution and add a little more acid, which dephlogisticates it further; but the nitrous acid always retains a little silver.

349 Blue vitriol cannot be formed by boiling a solution of alum with copper filings.

It has commonly been related by chemical authors, that blue vitriol will be formed by adding filings of copper to a boiling solution of alum. Mr Kirwan, however, has showed this to be an error; for after boiling a solution of alum for 20 hours with copper filings, not a particle of the metal was dissolved; the liquor standing even the test of the volatile alkali. The alum indeed was precipitated from the liquor, but still retained its saline form; so that the precipitation was occasioned only by the dissipation of the superfluous acid.

350 Why tin cannot be precipitated in its metallic form.

No metal is capable of precipitating tin in its metallic form; the reason of which, according to Mr Kirwan, is, because the precipitation is not the effect of a double affinity, but of the single greater affinity of its menstruum to every other metallic earth. Metals precipitated from the nitrous acid by tin are afterwards redissolved, because the acid soon quits the tin by reason of its becoming too much dephlogisticated.

351 Why metals precipitated by tin are afterwards redissolved

352 Precipitations by lead.

Lead precipitates metallic solutions in the vitriolic and marine acids but slowly, because the first portions of lead taken up form salts very difficult of solution, which cover its surface, and protect it from the further action of the acid; at the same time it contains so little phlogiston, that a great quantity of it must be dissolved before it will dissolve other metals. A solution of lead very much saturated cannot be precipitated by iron but with difficulty, if at all. Mr Kirwan conjectures that this may arise from some of the lead also being taken up in its metallic form, as is the case with mercury and silver. Iron will not precipitate lead from marine acid; for though a precipitate appears the acid is still adhering to the metal. On the contrary, iron is precipitated from its solution in this acid by lead, though very slowly.

353 Precipitations of mercury by copper.

Mercury is quickly precipitated from the vitriolic acid by copper, though the difference between the sum of the quiescent and divellent affinities is but very small. The precipitation, however, takes place, because the calx of mercury has a strong attraction for phlogiston; and a very small portion of what is contained in copper is sufficient to revive it.

354 It cannot be precipitated by silver from vitriolic acid.

Silver, however, is not able to precipitate mercury from the vitriolic acid, unless it contains copper; in which case a precipitation will ensue: but on distilling silver and turpeth mineral, the mercury will pass over in its metallic form; which shows that the affinity of the calx of mercury to phlogiston is increased by heat, though the difference betwixt the divellent and quiescent powers is very small.

355 Why mercury and silver precipitate one another from the nitrous acid.

Mercury appeared to be precipitated by silver from the nitrous acid, though very slowly; but when the solution was made without heat, it was not at all precipitated. On the other hand, mercury precipitates silver from this acid, not by virtue of the superiority of the usual divellent powers, but by reason of the attraction of mercury and silver for each other; for they form partly an amalgam and partly a vegetation, scarcely any thing of either remaining in the solution.

356 Corrosive sublimate cannot be precipitated by silver; but luna cornea may be decomposed by mercury, and sublimate by silver, in the dry way.

Silver does not precipitate mercury from the solution of corrosive sublimate; but, on the contrary, mercury precipitates silver from the marine acid: and if a solution of *luna cornea* in volatile alkali be triturated with mercury, calomel will be formed; yet on distilling calomel and silver together, the mercury will pass in its metallic form, and luna cornea will be formed. The same thing happens on distilling silver and corrosive sublimate, the affinity of calx of mercury to phlogiston increasing with heat.

357 Precipitations of bismuth.

Bismuth precipitates nothing from vitriol of copper in 16 hours; nor does copper from vitriol of bismuth. The two metallic substances, however, alternately precipitate one another from the nitrous acid, which proceed from their different degrees of dephlogistication.

358 Nickel precipitated by zinc.

Nickel will scarcely precipitate any metal except it be reduced to powder. A black powder is precipitated by means of zinc from the solution of nickel in

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in the vitriolic and nitrous acids, which has been shown by Bergman to consist of arsenic, nickel, and a little of the zinc itself. The latter, however, precipitates nickel from the marine acid.

359 Iron and nickel will scarcely precipitate one another.

The solutions of iron and nickel in the vitriolic acid mutually act upon these metals; but neither of them will precipitate the other in 24 hours, though on remaining longer at rest iron seems to have the advantage. Iron, however, evidently precipitates nickel from the nitrous acid; and though nickel seems to precipitate iron, yet this arises only from the gradual dephlogistication of the iron.

360 Precipitation of copper, lead, and bismuth by nickel.

Copper is precipitated in its metalic form from the vitriolic, nitrous, and marine acids, by nickel. The vitriolic and nitrous solutions of lead seem to act upon it without any decomposition, the calces uniting to each other. Lead seems for some time to be acted upon in the same manner by the vitriolic and nitrous solutions of nickel, but at last nickel seems to have the advantage; but a black precipitate appears which ever of them is put into the solution of the other. However, nickel readily precipitates vitriolic and nitrous solutions of bismuth; but in the marine acid both these semimetals are soluble in the solutions of each other: yet nickel precipitates bismuth very slowly, and only in part; while bismuth precipitates a red powder, supposed by Mr Kirwan to be ochre, from the solution of nickel.

361 Zinc cannot precipitate cobalt.

Cobalt is not precipitated by zinc either from the vitriolic or nitrous acids, though it seems to have some effect upon it when dissolved in that of sea-salt.

362 Cobalt precipitated by iron.

Iron precipitates cobalt from all the three acids, yet much of the semimetal is retained in the vitriolic and nitrous solutions of it, particularly the latter; which, after letting fall the cobalt, takes it up again, and lets fall a dephlogisticated calx of iron. Nickel

363 Nickel precipitates some heterogeneous matter from it.

also, though it does not precipitate cobalt itself, as appears by the remaining redness of the solution, yet constantly precipitates some heterogeneous matter from it. Solution of cobalt in the marine acid becomes colourless by the addition of nickel. Bismuth is soluble

364 Solutions of cobalt let fall a white powder on the addition of bismuth or copper.

in the vitriolic and nitrous solutions of cobalt, and throws down a small white precipitate, but does not affect the metallic part. Nor can we attribute these solutions in vitriolic acid to any excess in that acid, as they are dilute and made without heat. Copper also precipitates from the solution of cobalt a white powder supposed to be arsenic.

365 Precipitations of and by regulus of antimony.

The regulus of antimony has no effect on solution of copper in vitriolic acid, nor is precipitated by it from the same acid; but it dissolves slowly in vitriol of antimony. With solution of vitriol of lead it becomes red in 16 hours, but is scarcely precipitated by lead from the vitriolic acid. Powdered regulus also precipitates vitriol of mercury very slightly. Bismuth neither precipitates nor is precipitated by the regulus in 24 hours from the vitriolic acid. Tin precipitates the regulus from the nitrous acid; but if regulus be put into a solution of tin in the same acid, neither of the

366 A triple salt formed by iron, regulus of antimony, and marine acid.

metals will be found in the liquid in 16 hours, either by reason of the dephlogistication or of the union of the calces to each other.

Iron does not precipitate regulus of antimony entirely from the marine acid; but seems to form a triple salt, consisting of the acid and both calces. The regulus may also be dissolved by marine salt of iron.

367 Another formed by regulus of antimony, marine acid, and copper.

Copper does not precipitate regulus of antimony from marine acid in 16 hours; and if the regulus be put into marine salt of copper, it will be dissolved, and volatile alkalies will not give a blue, but a yellowish white precipitate; so that here also a triple salt is formed.

368 Precipitations of and by arsenic.

Solution of arsenic in vitriolic acid acts upon iron, lead, copper, nickel, and zinc; but scarce give any precipitate: neither is arsenic precipitated by iron from the nitrous acid, though it is by copper, and even silver gives a slight white precipitate. Regulus of arsenic, however, precipitates silver completely in 16 hours: whence the former precipitate seems to be a triple salt. Mercury also slightly precipitates arsenic from the nitrous acid, and seems to unite with it, though it is itself precipitated by regulus of arsenic in 24 hours.

369 Regulus of arsenic precipitated by bismuth from the nitrous acid;

Bismuth slightly precipitates arsenic from spirit of nitre, but regulus of arsenic forms a copious precipitate in the nitrous solution of bismuth; so that Mr Kirwan is of opinion that the calces unite. It is not precipitated from this acid by nickel, but the calces unite. Though regulus of arsenic produces a copious precipitate in the solution of nickel in nitrous acid, yet the liquor remains green; so that the nickel is certainly not precipitated. The white precipitate in this case seems to be arsenic slightly dephlogisticated. Regulus of arsenic also produces a white precipitate in the nitrous solution of cobalt, but the liquor still continues red.

370 And by copper from the marine acid.

Regulus of arsenic is precipitated from the marine acid by copper; but the precipitate does not strike a blue colour with volatile alkali, because the metal unites with the arsenic. The arsenic is also precipitated by iron. Tin is soluble in marine solution of arsenic, but Mr Kirwan could not observe any precipitation; nor does regulus of arsenic precipitate tin. Neither bismuth nor regulus of arsenic precipitate each other from marine acid in 16 hours. Regulus of antimony is also acted upon by the marine solution of arsenic, though it causes no precipitate, nor does the regulus of arsenic precipitate it.

§ 2. *Of the Quantities of Acid, Alkali, &c. contained in different Salts, with the Specific Gravity of the Ingredients.*

It is a problem by which the attention of the best modern chemists has been engaged, to determine the quantity of acid existing in a dry state in the various compound salts, resulting from the union of acid with alkaline, earthy, and metallic substances. In this way Mr Kirwan has greatly excelled all others, and determined the matter with an accuracy and precision altogether unlooked for. His decisions are founded on the following principles.

371 Specific gravity of bodies how found.

1. That the specific gravity of bodies is their weight divided by an equal bulk of rain or distilled water; the latter being the standard with which every other body is compared.

2. That if bodies specifically heavier than water be weighed in air and in water, they lose in water part of the weight which they were found to have in air; and

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and that the weight so lost is just the same as that of an equal bulk of water; and consequently, that their specific gravity is equal to their weight in air, or absolute weight divided by their loss of weight in water.

3. That if a solid, specifically heavier than a liquid, be weighed first in air and then in that liquid, the weight it loses is equal to the weight of an equal volume of that liquid; and consequently, if such solid be weighed first in air, then in water, and afterwards in any other liquid, the specific gravity will be as the weight lost in it by such solid, divided by the loss of weight of the same solid in water. This method of finding the specific gravity of liquids, our author found more exact than that by the aerometer, or the comparisons of the weights of equal measures of such liquids and water, both of which are subject to several inaccuracies.

372 To find the weight of an equal bulk of water where the specific gravity is known.

4. That where the specific gravity of bodies is already known, we may find the weight of an equal bulk of water; it being as the quotient of their absolute weight divided by their specific gravities: and this he calls their loss of weight in water.

Thus where the specific gravity and absolute weight of the ingredients of any compound are known, the specific gravity of such compound may easily be calculated; as it ought to be intermediate betwixt that of the lighter and that of the heavier, according to their several proportions: and this Mr Kirwan calls the *mathematical* specific gravity.

373 Mathematical specific gravity explained.

But in fact the specific gravity of compounds, found by actual experiment, seldom agrees with that found by calculation; but is often greater, without any diminution of the lighter ingredient.

374 Increased density of mixtures accounted for.

This increase of density, then, Mr Kirwan supposes to arise from a closer union of the component parts to each other than either had separately with its own integrant parts; and this more intimate union must, he thinks, proceed from the attraction of these parts to each other: for which reason he supposed, that this attraction might be estimated by the increase of density or specific gravity, and was proportionable to it; but soon found that he was mistaken in this point.

375 Weights of different kinds of air

With regard to the absolute weights of several sorts of air, our author adheres to the computations of Mr Fontana, at whose experiments he was present; the thermometer being at 55°, and the barometer at 29$\frac{1}{2}$ inches, or nearly so. These weights were as follow:

| | | |
|---|---|---|
| Cubic inch of | common air, | 0.385 |
| | fixed air, | 0.570 |
| | marine acid air, | 0.654 |
| | nitrous air, | 0.399 |
| | vitriolic acid air, | 0.778 |
| | alkaline air, | 0.2 |
| | inflammable air, | 0.03 |

376 Method of finding the quantity of pure acid contained in spirit of salt.

Mr Kirwan begins his investigations with the marine acid; endeavouring first to find the exact quantity of pure acid it contains at any given specific gravity, and then by means of it determining the weight of acid contained in all other acids. For if a given quantity of pure fixed alkali were saturated, first by a certain quantity of spirit of salt, and then by determined quantities of the other acids, he concluded, that each of these quantities of acid liquor must contain the same quantity of acid; and this being known, the remainder, being the aqueous part, must also be known. This conclusion, however, rested entirely on the supposition that the same quantity of all the acids was requisite for the saturation of a given quantity of fixed alkali; for if such given quantity of fixed alkali might be saturated by a smaller quantity of one acid than of another, the conclusion fell to the ground. The weight of the neutral salts produced might indeed determine this point in some measure; but still a source of inaccuracy remained; to obviate which he used the following expedient. 1. He supposed the quantities of nitrous and vitriolic acids necessary to saturate a given quantity of fixed alkali exactly the same as that of marine acid, whose quantity he had determined; and to prove the truth of this supposition, he observed the specific gravity of the spirit of nitre and oil of vitriol he employed, and in which he supposed, from the trial with alkalies, a certain proportion of acid and water. He then added to these more acid and water, and calculated what the specific gravity should be on the above supposition; and finding the result agreeable with the supposition, he concluded the latter to be exact. The following experiments were made on the marine acid.

377 Method of finding the specific gravity of spirit of salt.

Two bottles were filled nearly to the top with distilled water, of which they contained in all 1399.9 grains, and successively introduced into two cylinders filled with marine air; and the process was renewed, until the water had imbibed, in 18 days, about 794 cubic inches of the marine air. The thermometer did not rise all this time above 55°; nor sink, unless perhaps at night, above 50°; the barometer standing between 29 and 30 inches. This dilute spirit of salt then weighed 1920 grains; that is, 520.1 more than before; the weight of the quantity of marine air absorbed. The specific gravity of the liquor was found to be 1.225. Its loss of weight in water (that is, the weight of an equal bulk of water) should then be 1567.346 nearly; but it contained only, as we have seen, 1399.9 grains of water: subtracting this therefore from 1567.346, the remainder (that is, 167.446) must be the loss of 520.1 grains of marine acid; and consequently the specific gravity of the pure marine acid, in such a condensed state as when it is united to water, must be $\frac{520.1}{167.446}$, or 3.100.

Still, however, it might be suspected, that the density of this spirit did not entirely proceed from the mere density of the marine acid, but in part also from the attraction of this acid to water; and though the length of time requisite to make the water imbibe this quantity of marine acid air, naturally led to the supposition that the attraction was not very considerable, yet the following experiment was more satisfactory. He exposed 1440 grains of this spirit of salt to marine acid air for five days, the thermometer being at 50°, or below; and then found that it weighed 1562 grains, and consequently had imbibed 122 grains more. Its specific gravity was then 1.253, which was precisely what it should have been by calculation.

378 To find the proportion of pure air in other acid liquors.

Being now satisfied that the proportion of acid in spirit of salt was discovered, our author determined to find it in other acids also. For this purpose he took 180 grains of very strong oil of tartar *per deliquium*, and found that it was saturated by 180 grains of spirit of salt, whose specific gravity was 1.225; and by calculation

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calculation it appeared, that 180 grains of this spirit contained 48.7 grains of acid, and 131.3 of water. Hence he drew up a table of the specific gravities of acid liquors containing 48.7 grains of pure acid, with different proportions of water, from 50 to 410 parts; the liquor with the first proportion having a specific gravity of 1.497, and the latter weighing only 1.074. Mr Baume had determined the specific gravity of the strongest spirit of salt made in the common manner to 1.187, and Bergman 1.190; but we are told in the Paris Memoirs for 1700, that Mr Homberg had produced a spirit whose specific gravity was 1.300; and that made by Dr Priestley, by saturating water with marine acid air, must have been about 1.500. The spirit of salt, therefore, whose specific gravity is 1.261, has but little attraction for water, and therefore attracts none from the air; for which reason also it does not heat the ball of a thermometer, as the vitriolic and nitrous acids do; though Mr Cavallo found that this also had some effect upon the thermometer. Common spirit of salt, Mr Kirwan informs us, is always adulterated with vitriolic acid, and therefore unfit for these trials.

379 Quantities of acid, water, and alkali in digestive salt.

Mr Kirwan now set about investigating the quantity of acid, water, and fixed alkali, in digestive salt, or a combination of the marine acid with vegetable alkali. For this purpose he took 100 grains of a solution of tolerably pure vegetable alkali, that had been three times calcined to whiteness, the specific gravity of which was 1.097; diluting also the spirit of salt with different portions of water; the specific gravity of one sort being 1.015, and of another 1.098. He then found that the above quantity of solution of the vegetable alkali required for its saturation 27 grains of that spirit of salt whose specific gravity was 1.098, and 23.35 grains of that whose specific gravity was 1.115. Now, 27 grains of spirit of salt, whose specific gravity is 1.098, contain 3.55 grains of marine acid, as appears by calculation. The principles on which calculations of this kind are founded, our author gives in the words of Mr Cotes.

380 How to find the specific gravities of the different ingredients.

"The data requisite are the specific gravities of the mixture and of the two ingredients. Then, as the difference of the specific gravities of the mixture and the lighter ingredient is to the difference of the specific gravities of the mixture and the heavier ingredient; so is the magnitude of the heavier to the magnitude of the lighter ingredient. Then, as the magnitude of the heavier, multiplied into its specific gravity, is to the magnitude of the lighter multiplied into its specific gravity; so is the weight of the heavier to the weight of the lighter. Then, as the sum of these weights is to the weight of either ingredient; so is the weight given to the weight of the ingredient sought." Thus, in the present case, $1.098-1.000=.098$ is the magnitude of the heavier ingredient, viz. the marine acid, and $.098\times3.100=0.3038$ the weight of the marine acid; and on the other hand, $3.100-1.098=2.002$, the magnitude of the water; and $2.002\times1.000=2.002$ its weight; the sum of these weights is 2.3058: then if 2.3058 parts of spirit of salt contain 0.3038 parts acid, 27 grains of this spirit of salt will contain 3.55 acid. In the same manner it will be found, that 23.35 grains of spirit of salt, whose specific gravity is 1.115, contains 3.55 grains acid.

Our author describes very particularly his method of making the saturation of the alkali with the acid; which, as it is always difficult to hit with precision, we shall here transcribe. "It was performed by putting the glass cylinder which contained the alkaline solution on the scale of a very sensible balance, and at the same time weighing the acid liquor in another pair of scales; when the loss of weight indicated the escape of nearly equal quantities of fixed air contained in the solution. Then the acid was gradually added by dipping a glass rod in it, to the top of which a small drop of acid adhered. With this the solution was stirred, and very small drops taken up and laid upon bits of paper stained blue with radish juice. As soon as the paper was in the least reddened, the operation was completed; so that there was always a very small excess of acid, for which half a grain was constantly allowed; but no allowance was made for the fixed air, which always remains in the solution. But as on this account only a small quantity of the alkaline solution was used, this proportion of fixed air must have been inconsiderable. If one ounce of the solution had been employed, this inappretiable portion of fixed air, would be sufficient to cause a sensible error; for the quantity of fixed air lost by the difference betwixt the weight added to the 100 grains and the actual weight of the compound was judged of; and when this difference amounted to 2.2 grains, the whole of the fixed air was judged to be expelled: and it was found to be so; as 100 grains of the alkaline solution, being evaporated to dryness, in the heat of 300°, left a residuum which amounted to $10\frac{1}{7}$ grains, which contained 2.2 grains of fixed air."

381 Mr Kirwan's method of saturating the acid and alkali with accuracy.

382 Quantity of mild and caustic vegetable alkali saturated by a given weight of marine acid.

The result of this experiment was, that 8.3 grains of pure vegetable alkali, freed from fixed air and water, or 10.5 of mild fixed alkali, were saturated by 3.55 grains of pure marine acid; and consequently the resulting neutral salt should, if it contained no water, weigh 11.85 grains: but the salts resulting from this union (the solution being evaporated to perfect dryness in a heat of 160 degrees, kept up for four hours) weighed at a medium 12.66 grains. Of this 11.85 grains were acid and alkali; therefore the remainder, *viz.* 0.81 grains, were water. An hundred grains of perfectly dry digestive salt contain 28 grains acid, 6.55 of water, and 65.4 of fixed alkali.

383 Nitrous acid, when pure, cannot be made to exist in an aerial form.

In his experiments on the nitrous acid, Mr Kirwan made use only of the dephlogisticated kind, which appears pure and colourless as water. "This pure acid (says he) cannot be made to exist in the form of air, as Dr Priestley has shown; for when it is deprived of water and phlogiston, and furnished with a due proportion of elementary fire, it ceases to have the properties of an acid, and becomes dephlogisticated air. Its proportion therefore could not be determined in spirit of nitre as the marine acid had been in spirit of salt in the last experiment."—To determine the matter, the following experiments were made.

384 How to determine the quantity of pure acid contained in spirit of nitre.

1. To 1963.25 grains of dephlogisticated spirit of nitre, whose specific gravity was 1.419, he gradually added 179.5 grains of distilled water; and when it cooled, the specific gravity of the mixture was found to be 1.389.

2. To 1984.5 of this 178.75 grains of water were then added, and the specific gravity of the mixture found to be 1.362.

3. An hundred grains of a solution of fixed vegetable

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table alkali, whose specific gravity was 1.097, the same that had been formerly used in the experiments with spirit of salt, was found to be saturated by 11 grains of the spirit of nitre, whose specific gravity was 1.419, by 12 of that whose specific gravity was 1.389, and by 13.08 of that whose specific gravity was 1.362. These quantities were the medium of five experiments; and it was found necessary to dilute the acid with a small quantity of water. When this was neglected, part of the acid was phlogisticated, and flew off with the fixed air. Ten minutes were also allowed after each affusion for the matters to unite; a precaution which was likewise found to be absolutely necessary.

385 *Proportion of acid in spirit of nitre to that in spirit of salt.*

Upon the supposition, therefore, that a given quantity of vegetable fixed alkali is saturated by the same weight of both acids, we see that 11 grains of spirit of nitre, whose specific gravity is 1.419, contain the same quantity of acid with 27 grains of spirit of salt, whose specific gravity is 1.098, or 3.55 grains. The remainder of 11 grains, or 7.45 grains, is therefore mere water; and of consequence, if the density of the acid and water had not been increased by their union, the specific gravity of the pure nitrous acid should be

386 *To find the specific gravity of the pure nitrous acid.*

11.8729. But the specific gravity of the nitrous, as well as of the vitriolic acid, is augmented by its union with water; and therefore the loss of its weight in water is not exactly, as it would appear by calculation from the above premises, according to the rules already laid down.

387 *How to determine the accrued density on mixing spirit of nitre with water.*

To determine therefore the real specific gravity of the acid in its natural state, the quantity of *accrued* density must be found, and subtracted from the specific gravity of the spirit of nitre, whose true mathematical specific gravity will then appear. This our author endeavoured to effect by mixing different portions of spirit of nitre and water, remarking the degree of diminution they sustained by such union; but was never able to attain a sufficient degree of exactness in the experiment. He had recourse therefore to the following method, as affording more satisfaction, though not altogether accurate. Twelve grains of the spirit of nitre, whose specific gravity by observation was 1.389, contained, as our author supposed from the former experiment, 3.55 grains of real acid, and 8.45 of water: then if the specific gravity of the pure nitrous acid were 11.872, that of this compound acid and water should be 1.371; for the loss of 3.55 should be 0.299, and the loss of the water 8.45, the sum of the losses 8.749. Now, $\frac{12}{8.749}=1.371$: but the specific gravity, as already mentioned, was 1.389: therefore the accrued density was at least 0.18. the difference betwixt 1.389 and 1.371. This calculation indeed is not altogether exact: but our author concludes, that 0.18 is certainly a near approximation to the degree of density that accrues to 3.55 grains of acid by their union to 7.45 grains of water: therefore, subtracting this from 1.419, we have nearly the mathematical specific gravity of that proportion of acid and water, namely, 1.401.

388 *To determine the mathematical specific gravity of this acid.*

Again, since 11 grains of this spirit of nitre contain 3.55 grains acid, and 7.45 of water, its loss of weight should be $\frac{11}{1.401}=7.855$; and subtracting the loss of the aqueous part from this, the remainder 0.45 is the loss of the 3.55 grains acid; and consequently the true specific gravity of the pure and mere nitrous acid is $\frac{3.55}{0.405}=8.7654$. This being settled, the mathematical specific gravity and true increase of density of the above mixtures will be found. Thus the mathematical specific gravity of 12 grains of that spirit of nitre, whose specific gravity, by observation, was 1.389, must be 1.355; supposing it to contain 3.55 grains acid and 8.45 of water. For the loss of 3.55 grains acid is $\frac{3.55}{8.763}=0.405$, and the loss of water 8.45; the sum of these losses is 8.855. Then $\frac{12}{8.855}=1.355$; and consequently the accrued density is 1.389—1.355=.034. In the same manner it will be found that the mathematical specific gravity of 13.08 grains of that spirit of nitre, whose specific gravity by observation was 1.362, must be 1.315; and consequently its accrued density .047.

389 *Experiment to determine the quantity of real acid in spirit of nitre.*

The whole of this, however, still rests on the supposition that each of these portions of spirit of nitre contain 3.55 grains of acid. To verify this supposition, our author examined the mathematical specific gravities of the first mixture he had made of spirit of nitre and water in large quantities; for if the mathematical specific gravities of these agreed exactly with those of the quantities he had supposed in smaller portions of each, he could not but conclude that the suppositions of such proportions of acid and water, as he had determined in each, were just.

390 *Table of specific gravities for spirit of nitre, how constructed.*

This being determined by proper calculations, Mr Kirwan next proceeded to construct another table of specific gravities, continuing his mixtures, till the mathematical specific gravities found by observation nearly coincided with those made by calculation. In this table the spirit of nitre was mixed with water in various proportions, but after a different manner from that observed with the spirit of salt. Nine grains of the spirit containing 3.55 grains of pure acid were mixed with 5.45 of water; the accrued density of the mixture was found to be nothing, the mathematical specific gravity 1.537, and the specific gravity by observation was found the same. When 10 grains of spirit were mixed with 6.45 of water, the accrued density was 0.009, the mathematical specific gravity 1.458, and the specific gravity by observation 1.467. In this manner he proceeded until 38.90 grains of water were mixed with 42.45 of spirit. In this case the accrued density was found to be 0.002, the mathematical specific gravity 1.080, and the specific gravity by observation 1.082.

The intermediate specific gravities, in a table of this kind, may be found by taking an arithmetical mean betwixt the specific gravities, by observation, betwixt which the desired specific gravity lies, and noting how much it exceeds or falls short of such arithmetical mean; and then taking also an arithmetical mean betwixt the mathematical specific gravities betwixt which that sought for must lie, and a proportionate excess or defect.

The specific gravity of the strongest spirit of nitre yet made, is, according to Mr Baume, 1.500, and according to Mr Bergman 1.586.

Our author next proceeded to examine the propor-

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tion of acid, water, and fixed alkali in nitre, in a manner similar to what he had already done with digestive salt; and found that 100 grains of perfectly dry nitre contained 28.48 grains of acid, 5.2 of water, and 66.32 of fixed alkali.

391 Quantity of acid, water, and alkali in nitre determined.

Some experiments of the same kind had been made by M. Homberg; the results of which our author compared with those of his own. The specific gravity of the spirit of nitre which M. Homberg made use of was 1.349; and of this, he says, one ounce two drachms and 36 grains, or 621 troy grains, are required to saturate one French ounce (472.5 troy) of dry salt of tartar. According to Mr Kirwan's computation, however, 613 grains are sufficient; for the specific gravity lies between the specific gravities by observation 1.362 and 1.337, and is nearly an arithmetical mean between them. The corresponding mathematical specific gravity lies between the quantities marked in Mr Kirwan's table 1.315 and 1.286, being nearly 1.300. Now the proportion of acid and water in this is 2.629 of acid and 7.465 of water; for 8.765—1.300=7.465 of water, and 8.765×.300=2.629 of acid; and the sum of both is 10.044. Now, since 10.5 grains of mild vegetable alkali require 3.53 grains of acid for their saturation, 472.5 will require 159.7; therefore if 10.044 grains of nitre contain 2.629 grains acid, the quantity of this spirit of nitre requisite to give 159.7 will be 613.2 nearly, and thus the difference with M. Homberg is only about eight grains.

392 Homberg's experiments compared with those of Mr Kirwan.

393 Different results of Homberg and Kirwan's experiments accounted for.

M. Homberg says he found his salt, when evaporated to dryness, to weigh 186 grains more than before, but by Mr Kirwan's experiment, it should weigh but 92.8 grains more than at first; the cause of which difference will be mentioned in treating of vitriolated tartar, as it cannot be entirely attributed to the difference of evaporation.

He also asserts, that one ounce (472.5 Troy grains) of this spirit of nitre contains 141 grains of Troy of real acid. According to Mr Kirwan's computation, however, it contains only 123.08 grains of real acid. But this difference evidently proceeds from his neglecting the quantity of water that certainly enters into the composition of nitre; for he proceeds on this analogy, 621 : 186.6 :: 472.5 : 141.

394 Mr Kirwan's experiments confirmed by one of Fontana.

Our author observes, that the proportion of fixed alkali assigned by him to nitre is fully confirmed by an experiment of Mr Fontana's inserted in Rozier's Journal for 1778. He decomposed two ounces of nitre by distilling it with a strong heat for 18 hours. After the distillation there remained in the retort a substance purely alkaline, amounting to 10 French drachms and 22 grains. Now two French ounces contain 945 grains Troy, and the alkaline matter 607 grains of the same kind: according to Mr Kirwan's computation the two ounces of nitre ought to contain 625 grains of alkali. Such a small difference he supposes to proceed from the loss in transferring from one vessel to another, weighing, filtering, evaporating, *&c.* Mr Kirwan also shows in a very particular manner the agreement of his calculations with the experiments of M. Lavoisier on mercury dissolved in spirit of nitre; but our limits will not allow us to insert an account of them.

When finding the quantity of pure acid contained in oil of vitriol, our author made use of such as was not dephlogisticated; but, though pale, yet a little inclining to red. It contained some whitish matter, as he preceived by its growing milky on the affusion of pure distilled water; but he imagines it was as pure as the kind used in all experiments.

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395 Experiments on oil of vitriol.

To 2519.75 grains of this oil of vitriol, whose specific gravity was 1.819, he gradually added 180 grains of distilled water, and six hours after found its specific gravity to be 1.771.—To this mixture he again added 178.75 grains of water, and found its specific gravity, when cooled to the temperature of the atmosphere, to be 1.719, at which time it was milky. The same quantity of the oil of tartar abovementioned was then saturated with each of these kinds of oil of vitriol in the manner already described. The saturation was effected (taking a medium of five experiments) by 6.5 grains of that whose specific gravity was 1.819, by 6.96 grains of that whose specific gravity was 1.771, and by 7.41 of that whose specific gravity was 1.719.

396 Dilution of oil of vitriol why necessary in these experiments.

It was found necessary to add a certain proportion of water to each of these sorts of oil of vitriol; for when they were not diluted, part of the acid was phlogisticated, and went off with the fixed air; but knowing the quantity of water that was added, it was easy to find by the rule of proportion the quantity of each sort of vitriol that was taken up by the alkali. Hence it was supposed, that each of these quantities of oil of vitriol of different densities contained 3.55 grains of acid; as they saturated the same quantity of vegetable fixed alkali with 11 grains of spirit of nitre, which contained that quantity of acid.

397 To find the specific gravity of pure vitriolic acid.

It was next attempted to find the specific gravity of the pure vitriolic acid in a manner similar to that by which the gravity of the nitrous acid was found; as it cannot be had in the shape of air, unless when united with such a quantity of phlogiston as quite alters its properties. The loss of 6.5 grains of oil of vitriol, whose specific gravity is 1.819, is $\frac{6.5}{1.819} = 3.572$; but as these 6.5 grains contained, besides 3.55 of acid, 2.95 of water, the loss of this must be subtracted from the entire loss; and then the remainder, or 0.622, is the loss of the pure acid part in that state or density to which it is reduced by its union with water. The specific gravity, therefore, of the pure vitriolic acid, in this state of density, is $\frac{3.55}{0.622} = 5.707$. But to find its natural specific gravity, we must find how much its density is increased by its union with this quantity of water: and in order to observe this, he proceeded as before with the nitrous acid. 6.96 grains of oil of vitriol, whose specific gravity was 1.771, contained 3.55 of acid and 3.41 of water; then its specific gravity by calculation should be 1.726; for the loss of 3.55 grains of acid is $\frac{3.55}{5.707} = 0.622$; the loss of 3.41 grains of water is 3.41; the sum of the losses 4.032: then $\frac{6.96}{4.032} = 17.16$; therefore the accrued density is 1.771—1.726=0.45. Taking this therefore from 1.819, its mathematical specific gravity will be 1.774. Then the loss of 6.5 grains of oil of vitriol, whose specific gravity by observation is 1.819, will be found to be $\frac{6.5}{1.774} = 4.663$; but of this, 2.95 grains are the loss

of

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of the water it contains, and the remainder 0.714 are the loſs of the mere acid part. Then $\frac{3.55}{0.714}$ is nearly the true ſpecific gravity of the pure vitriolic acid. The ſpecific gravity of the moſt concentrated oil of vitriol yet made, is, according to M. Baume and Bergman, 2.125.

Mr Kirwan now conſtructed a table of the ſpecific gravities of vitriolic acids, of different ſtrengths, in a manner ſimilar to thoſe conſtructed for ſpirit of ſalt and ſpirit of nitre; but for which, as well as the others,

398 Quantity of acid, alkali, and water, in vitriolated tartar determined.

we muſt refer to Phil. Tranſ. vol. 71. He then proceeded to find the proportion of acid, water, and fixed alkali, in vitriolated tartar as he had before done in ſal digeſtivus and nitre.—He found the ſalts reſulting from the ſaturation of the ſame oil of tartar, with portions of oil of vitriol, of different ſpecific gravities, to weigh at a medium 12,45 grains. Of this weight only 11.85 grains were alkali and acid. The remainder, therefore, was water, *viz* 0.6 of a grain. Conſequently 100 grains of perfectly dry tartar vitriolate contain 21.58 grains acid, 4.82 of water, and 66.67 of fixed vegetable alkali.—In drying this ſalt, a heat of 240 degrees was made uſe of, to expel the adhering acid more thoroughly. It was kept in this heat for a quarter of an hour.

399 Difference with Mr Homberg accounted for.

According to Mr Homberg, one French ounce, or 472.5 grains troy, of dry ſalt of tartar, required 297.5 grains troy, of oil of vitriol, whoſe ſpecific gravity was 1.674, to ſaturate it: but by Mr Kirwan's calculation, this quantity of fixed alkali would require 325 grains; a difference which, conſidering the different methods they made uſe of for determining the ſpecific gravities (Homberg's method by menſuration, giving it always leſs than Mr Kirwan's) the different deſiccation of their alkalies, &c. may be accounted inconſiderable.

The ſalt produced, according to Mr Homberg, weighed 182 grains troy above the original weight of the fixed alkali; but by Kirwan's experiment, it ſhould weigh but 87.7 grains more. "It is hard to ſay (adds Mr Kirwan) how Mr Homberg could find this great exceſs of weight, both in nitre and tartar vitriolate; unleſs he meant by the weight of the ſalt of tartar the weight of the mere alkaline part diſtinct from the fixed air it contained: and indeed one would be tempted to think he did make the diſtinction; for in that caſe the exceſs of weight would be nearly ſuch as he determined it."

From Mr Homberg's calculations, he inferred that one ounce (472.5 grains) of oil of vitriol contains 291.7 grains of acid. Mr Kirwan computes the acid only at 213.3 grains; but Homberg made no allowance for the water contained in tartar vitriolate; and imagined the whole increaſe of weight proceeded from the acid that is united in it to the fixed alkali. Now the aqueous part in 560 grains of tartar vitriolate amounts to 36 grains; the remaining difference may he attributed to the different degrees of deſiccation, &c.

400 Specific gravity of the acetous acid.

On the acetous acid Mr Kirwan did not make any experiment; but by calculating from thoſe of Homberg, he finds that the ſpecific gravity of the pure acetous acid, free from ſuperfluous water, ſhould be 2.30. "It is probable (ſays Mr Kirwan), that its affinity to water is not ſtrong enough to cauſe any irregular increaſe in its denſity; at leaſt what can be expreſſed by three decimals: and hence its proportion of acid and water may always be calculated from its ſpecific quantity and abſolute weight."

An hundred parts of foliated tartar, or, as it ſhould rather be called, acetous tartar, contain, when well dried, 32 of fixed alkali, 19 of acid, and 49 parts of water.—The ſpecific gravity of the ſtrongeſt concentrated vinegar yet made is 1.069.—It is more difficult to find the point of ſaturation with the vegetable than with the mineral acids, becauſe they contain a mucilage that prevents their immediate union with alkalies; and hence they are commonly uſed in too great quantity: they ſhould be uſed moderately hot, and ſufficient time allowed them to unite.

401 Specific gravity of ſtrong vinegar.

402 Vegetable fixed alkali takes up an equal quantity of all the mineral acids.

From all the experiments above related, Mr Kirwan concludes, 1. That the fixed vegetable alkali takes up an equal quantity of the three mineral acids, and probably of all pure acids; for we have ſeen that 8.2 grains of pure vegetable alkali, that is, free from fixed air, take up 3.55 grains of each of theſe acids; and conſequently 100 parts of cauſtic fixed alkali would require 42.4 parts of acid to ſaturate them. But Mr Bergman has found that 100 parts of cauſtic fixed vegetable alkali take up 47 parts of the aerial acid; which, conſidering that his alkali might contain ſome water, differs but little from that already given. It ſhould ſeem, therefore, that alkalies have a certain determined capacity of uniting to acids, that is, to a given weight of acids; and that this capacity is equally ſatiated by a given weight of any pure acid indiſcriminately. This weight is about 2.35 of the vegetable alkali.

403 Quantity of the alkali neceſſary to ſaturate the acids.

2. That the three mineral acids, and probably all pure acids, take up 2.253 times their own weight of pure vegetable alkali, that is, are ſaturated by that quantity.

404 Increaſe of denſity in compound ſubſtances.

3. That the denſity accruing to compound ſubſtances, from the union of their compound parts, and exceeding its mathematical ratio, increaſes from a *minimum*, when the quantity of one of them is very ſmall in proportion to that of the other; to a *maximum*, when their qualities differ leſs: but that the attraction, on the contrary, of that part which is in the ſmalleſt quantity to that which is in the greater, is at its maximum when the accrued denſity is at its minimum; but not reciprocally: and hence the point of ſaturation is probably the maximum of denſity and the minimum of ſenſible attraction of one of the parts. Hence no decompoſition operated by means of a ſubſtance that has a greater affinity with one part of a compound than with the other, and than theſe parts have with each other, can be complete, unleſs the minimum affinity of this third ſubſtance be greater than the maximum affinity of the parts already united. Hence alſo few decompoſitions are complete, unleſs a double affinity intervenes; and hence the laſt portions of the ſeparated ſubſtance adhere ſo obſtinately to that with which it was firſt united, as all chemiſts have obſerved.—Thus, though acids have a greater affinity to phlogiſton than the earths of the different metals have to it, yet they can never totally dephlogiſticate theſe earths but only to a certain degree; ſo, though atmoſpheric air, and particularly dephlogiſticated air, attracts phlogiſton more ſtrongly than the nitrous acid does, yet not even dephlogiſticated air can deprive the nitrous acid totally of its phlogiſton; as is evident from the

405 Why decompoſitions are ſometimes incomplete, and otherwiſe.

406 Why the laſt portions of a ſubſtance obſtinately adhere to that with which it was united.

407 Acids can never totally dephlogiſticate metallic earths.

the red colour of the nitrous acid, when nitrous air and dephlogiſticated air are mixed together. Hence mercury precipitated from its ſolution in any acid, even by fixed alkalies, conſtantly retains a portion of the acid to which it was originally united, as Mr Bayen has ſhown. Thus alſo the earth of alum, when precipitated in like manner from its ſolution, retains part of the acid; and thus ſeveral anomalous decompoſitions may be explained.

408 **Why precipitates of mercury and alum retain part of the acid.**

409 **Alkalies phlogiſticate concentrated acids.**

4. That concentrated acids are in ſome meaſure phlogiſticated, and evaporate by union with fixed alkalies.

410 **How to determine the quantity of pure acid in any ſubſtance.**

5. That, knowing the quantity of fixed alkali in oil of tartar, we may determine the quantity of real pure acid in any other acid ſubſtance that is difficultly decompoſed; as the ſedative acid, and thoſe in vegetables and animals. For 10.5 grains of the mild alkali will always be ſaturated by 3.55 grains of real acid; and reciprocally, the quantity of acid in any acid liquor being known, the quantity of real alkali in any vegetable alkaline liquor may be found.

411 **Specific gravity of fixed air determined.**

Having thus determined the quantity of acid contained in the liquids of that kind uſually employed in chemiſtry, as well as the ſpecific gravities of the acids themſelves, Mr Kirwan became deſirous of inveſtigating the gravity of fixed and volatile alkalies. But as theſe ſubſtances are not eaſily preſerved from uniting themſelves with fixed air, he was led to conſider the gravity of this in its fixed ſtate, as an element neceſſary for the calculation of the quantities of the alkalies.

412 **Specific gravity of fixed vegetable alkali inveſtigated.**

To find the ſpecific gravity of the fixed vegetable alkali, our author proceeded in a manner ſimilar to that already deſcribed, excepting that he weighed it in ether inſtead of ſpirit of wine. The reſults of his experiments are.

413 **Quantity of earth contained in it.**

1. That 100 grains of this alkali contain about 6.7 grains of earth; which, according to Mr Bergman, is ſiliceous. It paſſes the filter along with it when the alkali is not ſaturated with fixed air; ſo that it ſeems to be held in ſolution in the ſame manner as in the *liquor ſilicum*.

414 **Quantity of fixed air in oil of tartar and dry vegetable fixed alkali.**

2. The quantity of fixed air in oil of tartar and dry vegetable fixed alkali is various at various times, and in various parcels of the ſame ſalt; but in the purer alkalies it may be reckoned at a medium 21 grains in 100; and hence the quantity of this alkali may very nearly be gueſſed at in any ſolution, by adding a known weight of any dilute acid to a given weight of ſuch a ſolution, and then weighing it again; for as 21 is to 100, ſo is the weight loſt to the weight of mild alkali in ſuch ſolution. The ſpecific gravity of mild and perfectly dry vegetable fixed alkali, four times calcined, free from ſiliceous earth, and containing 21 *per cent.* of fixed air, was found to be 5.0527. When it contains more fixed air the gravity is probably higher, except when it is not perfectly dry; and hence the ſpecific gravity of this alkali, when cauſtic, was ſuppoſed by Mr Kirwan to be 4.234. For this reaſon the fixed alkalies, when united to aerial acid, are ſpecifically heavier than when united either to the vitriolic or nitrous.

415 **Mr Watſon's account of the ſpecific gravity of ſalt of tartar, &c.**

Thus Mr R. Watſon, in the Philoſophical Tranſactions for 1770, informs us, that he found the ſpecific gravity of dry ſalt of tartar, including the ſiliceous earth it naturally contains, to be 2.761; whereas the ſpecific gravity of vitriolated tartar was only 2.636, and that of nitre 1.933. The reaſon why nitre is ſo much lighter than tartar vitriolate is, that it contains much more water, and the union of the acid with the water is leſs intimate.

416 **Why nitre is ſo much lighter than vitriolated tartar.**

417 **Quantity of fixed air in pure vegetable alkalies determined by Mr Cavendiſh.**

Impure vegetable fixed alkalies, ſuch as pearl-aſh, potaſhes, &c. contain more fixed air than the purer kind. According to Mr Cavendiſh, pearl-aſh contains 28.4 or 20.7 *per cent.* of fixed air. Hence in lyes made from theſe ſalts, of equal ſpecific gravities with thoſe of a purer alkali, the quantity of ſaline matter will probably be in the ratio of 28.4 or 28.7 to 21; but this additional weight is only fixed air. Much alſo depends on their age; the oldeſt containing moſt fixed air. Our author alſo gives a table of the ſpecific gravities of different ſolutions of vegetable fixed alkali, in a manner ſimilar to what he had done before with the acids. He begins with 64.92 grains of a ſolution containing 26.25 grains of ſalt, and 38.67 of water. The accrued denſity he finds to be .050, the mathematical ſpecific gravity 1.445, and the ſpecific gravity by obſervation 1.495. By continually diluting the ſolution containing the ſame quantity of ſalt, he brings the abſolute weight of it at laſt to 341.94 grains, of which 317.49 are water; the accrued denſity 0.01, the mathematical ſpecific gravity 1.061, and the ſpecific gravity by obſervation 1.062.

418 **Quantity of acid taken up by mild fixed alkali exactly determined.**

In a ſubſequent paper on this ſubject, Philoſophical Tranſactions, vol. 72, p. 179, our author corrects a ſmall miſtake concerning the quantity of acid taken up by 10.5 grains of mild vegetable alkali. In his former computations he had made no allowance for the ſmall quantity of earth contained in this quantity of alkali; which, though inconſiderable in it, becomes of conſequence where the quantities are large. The error, however, occaſioned by this omiſſion, is ſenſible in his calculations concerning the quantities of acid alkali, &c. contained in the neutral ſalts, as well as in that concerning the vegetable alkali. When the correction is properly made, he ſays, it will be found that 100 grains of ſuch alkali, free from earth, water, and fixed air, take up 46.77 of the mineral acids, that is, of the mere acid part; and 100 grains of common mild vegetable alkali take up 36.23 grains of real acid.

419 **Of the quantity of ingredients in vitriolated tartar;**

An hundred grains of perfectly dry tartar vitriolate contain 30.21 of real acid, 64.61 of fixed alkali, and 5.18 of water. Cryſtallized tartar vitriolate loſes only one *per cent.* of water in a heat in which its acid is not ſeparated in any degree; and therefore contains 6.18 of water. An hundred grains of nitre, perfectly dry, contain 30.86 of acid, 66 of alkali, and 3.14 of water; but in cryſtallized nitre the proportion of water is ſomewhat greater; for 100 grains of thoſe cryſtals being expoſed to a heat of 180° for two hours, loſt three grains of their weight without exhaling any acid ſmell; but when expoſed to a heat of 200 degrees, the ſmell of the nitrous acid is diſtinctly perceived.

420 **In nitre;**

Hence 100 grains of cryſtallized nitre contain 29.89 of mere acid, 63.97 of alkali, and 6.14 of water. An hundred grains of digeſtive ſalt perfectly dry, contain 29.68 of marine acid, 63.47 of alkali, and 6.85 of water.

421 **In digeſtive ſalt.**

One hundred grains of cryſtallized digeſtive ſalt loſe but one grain of their weight before the ſmell of the marine acid is perceived; and hence they contain 7.85 grains of water.

Another miſtake, more difficult to be corrected, was his ſuppoſing the mixtures of oil of vitriol and water, and ſpirit of nitre and water, had attained their maximum of denſity when they had cooled to the tempera-

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ture of the atmosphere; which at the time he made the experiment was between 50° and 60° of Fahrenheit. The mixture with oil of vitriol had been suffered to stand six hours; but when the acid was so much diluted as to occasion little or no heat, it was allowed to stand only for a very little time. Several months afterwards, however, many of these mixtures were found much denser than when he first examined them; and it was discovered, that at least twelve hours rest was necessary before concentrated oil of vitriol, to which even twice its weight of water is added, can attain its utmost density; and still more when a smaller proportion of water is used. Thus when he made the mixture of 2519.75 grains of oil of vitriol, whose specific gravity was 1.819, with 180 of water, he found its density six hours after 1.771, but after 24 hours it was 1.798: and hence, according to the methods of calculating already laid down, the accrued density was at least .064 instead of .045. But by using oil of vitriol still more concentrated, whose specific gravity was 1.8846, he was enabled to make a still nearer approximation; and found, that the accrued density of oil of vitriol, whose specific gravity is 1.819, amounts to 0.104, and consequently its mathematical specific gravity is 1.715. Six grains and a half of this oil of vitriol contained, as has been already observed, 3.55 of mere acid, and the remainder was water. The weight of an equal bulk of water is 3.79 grains; and subtracting from this the weight of the water that enters into the composition of the oil of vitriol, it will be found, that the weight of a bulk of water equal to the acid part is 0.84; and consequently the specific gravity of the mere acid part is 4.226. Thus, by constantly allowing the mixtures to rest at least 12 hours, until the oil of vitriol was diluted with four times its weight of water, and then only six hours before the density of the mixtures was examined, he constructed another table, in which 1000 grains of liquor contained 612.05 of pure acid, 387.95 of water, the accrued density being .07, and the mathematical specific gravity 1.877. Increasing the quantity of water till the acid weighed 7000 grains, and the water 6387.95, he found the accrued density .059, and the mathematical specific gravity 1.069. By a similar correction of his experiments on the acid of nitre, he found its density to be 5.530; a similar table was constructed for it, for which we refer our readers to the 72d volume of the Philosophical Transactions.

422 Time required by mixtures of mineral acids and water to acquire their utmost density.

423 Alteration of the density of acids by various degrees of heat.

These experiments were made when the thermometer stood between 50° and 60° of Fahrenheit; but, as it might be suspected that the density of acids is considerably altered at different degrees of temperature, he endeavoured to find the quantity of this alteration in the following manner: To calculate what this density would be at 55°, he took some dephlogisticated spirit of nitre, and examined its specific gravity at different degrees of heat; which was found to be as follows,

| Degrees of heat. | Specific gravity. |
|---|---|
| 30 | 1.4653 |
| 46 | 1.4587 |
| 86 | 1.4302 |
| 120 | 1.4123 |

The total expansion of this spirit of nitre, therefore, from 30 to 120 degrees, that is, by 90° of heat, was 0.0527; for 1.4650=4123+.0527. By which we see, that the dilatations are nearly proportional to the degrees of heat: for beginning with the first dilatation from 30 to 46 degrees, that is, by 16 degrees of heat, we find that the difference between the calculated and observed dilatations is only $\frac{30}{10000}$; a difference of no consequence in the present case, and which might arise from the immersion of the cold glass-ball filled with mercury in the liquor. In the next case the difference is still less, amounting only to $\frac{21}{100000}$.

With another, and somewhat stronger spirit of nitre, the specific gravities were as follow:

| Degrees of heat. | Specific gravity. |
|---|---|
| 34 | 1.4750 |
| 49 | 1.4653 |
| 150 | 1.3792 |

Here also the expansions were nearly proportional to the degrees of heat; for 116° of heat, the difference between 34 and 150, produce an expansion of 0.0958; and 15° of heat, the difference between 34 and 49, produce an expansion of 0.0097; and by calculation 0.0123: which last differs from the truth only by $\frac{21}{100000}$.

484 Strong spirit of nitre more expanded by heat than weak, and why.

From this experiment we see, that the stronger the spirit of nitre is, the more it is expanded by the same degree of heat; for if the spirit of nitre of the last experiment were explained in the same proportion as in the former, its dilatation, by 116 degrees of heat, should be 0.0679; whereas it was found to be 0.0958.

As the dilatation of the spirit of nitre is far greater than that of water by the same degree of heat, and as it consists only of acid and water; it clearly follows, that its superior dilatability must be owing to the acid part: and hence the more acid that is contained in any quantity of spirit of nitre, the greater is its dilatability. We might therefore suppose, that the dilatation of nitre was intermediate betwixt the quantity of water it contains and that of the acid. But there exists another power also which prevents this simple result, *viz.* the attraction of the acid and water to each other, which makes them occupy less space than the sum of their joint volumes; and by this condensation our author explains his phrase of *accrued density*. Taking this into the account, we may consider the dilatation of the spirit of nitre as equal to those of the quantities of water and acid it contains, minus the condensation they acquire from their mutual attraction; and this rule holds as to all other heterogeneous compounds.

425 Exact quantity of dilatation of spirit of nitre.

426 Of the quantities of acid and water contained in spirit of nitre.

To find the quantities of acid and water in spirit of nitre, whose specific gravity was found in degrees of temperature different from those for which the table was constructed, viz. 54°, 55°, or 56° of Fahrenheit, the surest method is to find how much that spirit of nitre is expanded or condensed by a greater or lesser degree of heat; and then, by the rule of proportion, find what its density would be at 55°. But if this cannot be done, we shall approach pretty near the truth if we allow $\frac{10}{10000}$ for every 15° degrees of heat above or below 55° of Fahrenheit, when the specific gravity is between 1.400 and 1.500, and $\frac{8}{10000}$ when the specific gravity is between 1.600 and 1.800.—The dilatations of oil and spirit of vitriol were found to be exceedingly irregular, probably by reason of a white foreign matter, which is more or less suspended or dissolved in it, according to its greater or lesser dilutions;

and

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and this matter our author did not separate, as he intended to try the acid in the ftate in which it is commonly ufed. In general he found that 15° of heat caufed a difference of above $\frac{8}{1000}$ in its fpecific gravity, when it exceeds 1.800, and of $\frac{3}{1000}$ when its fpecific gravity is between 1.400 and 1.300—The dilatations of fpirit of falt are very nearly proportional to the degrees of heat, as appears by the following table.

427 Dilatation of fpirit of falt by various degrees of heat.

| Degrees of heat. | Specific gravity. |
|---|---|
| 33 | 1.1916 |
| 54 | 1.1860 |
| 66 | 1.1820 |
| 128 | 1.1631 |

Hence $\frac{6}{1000}$ fhould be added or fubtracted for every 21° above or below 55°, in order to reduce it to 55°, the degree for which its proportion of acid and water was calculated. The dilatability of this acid is much greater than that of water, and even than that of the nitrous acid of the fame denfity.

428 Quantity of pure acid taken up by various fubftances.

Our author next proceeds to confider the quantity of pure acids taken up at the point of faturation by the various fubftances they unite with.—He begins with the mineral alkali. Having rendered a quantity of this cauftic in the ufual manner, and evaporating one ounce of the cauftic folution to perfect drynefs, he found it to contain 20.25 grains of folid matter. He was affured, that the watery part alone exhaled during evaporation, as the quantity of fixed air contained in it was very fmall, and to diffipate this a much greater heat would have been requifite than that which he ufed. This dry alkali was diffolved in twice its weight of water; and faturating it with dilute vitriolic acid, he found it to contain 2.25 grains of fixed air; that being the weight which the faturated folution wanted of being equal to the joint weights of water, alkali, and fpirit of vitriol employed.

429 Mineral alkali how prepared for thefe experiments.

430 Quantity of vitriolic acid neceffary to faturate it.

The quantity of mere vitriolic acid neceffary to faturate 100 grains of pure mineral alkali was found to be 60 or 61 grains; the faturated folution thus formed being evaporated to perfect drynefs weighed 36.5 grains; but of this weight only 28.38 were alkali and acid; the remainder, that is, 8.12 grains, therefore, were water. Hence 100 grains of Glauber's falt, perfectly dried, contained 29.12 of mere vitriolic acid, 48.6 of mere alkali, and 22.28 of water. But Glauber's falt cryftallized contains a much larger proportion of water; for 100 grains of thefe cryftals heated red hot loft 55 grains of their weight; and this lofs Mr Kirwan fuppofes to arife merely from the evaporation of the watery part, and the remaining 45 contained alkali, water, and acid, in the fame proportion as the 100 grains of Glauber's falt perfectly dried abovementioned. Then thefe 45 contained 13.19 grains of vitriolic acid, 21.87 of fixed alkali, and 9.94 of water: confequently 100 grains of cryftallized Glauber's falt contains 13.19 of vitriolic acid, 21.87 of alkali, and 64.94 of water.

431 Quantity of ingredients in Glauber's falt.

432 Quantity of mineral alkali taken up by dephlogifticated nitrous acid;

On faturating the mineral alkali with dephlogifticated nitrous acid, it was found that 100 grains of the alkali took up 57 of the pure acid in the experiment he moft depended upon; though in fome others this quantity varied by a few grains: he concludes, therefore, that the quantity of alkali taken up by this acid is nearly the fame as that taken up by the vitriolic. Suppofing this quantity to be 57 grains, then 100 grains of cubic nitre, perfectly dry, contain 30 of acid, 52.18 of alkali, and 17.82 of water: but cubic nitre cryftallized contains fomething more water; for 100 grains of thefe cryftals lofe about four by gentle drying; therefore 100 grains of the cryftallized falt contain 28.8 of acid, 50.09 of alkali, and 21.11 of water.



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An hundred grains of mineral alkali require from 63 to 66 or 67 grains of pure marine acid to faturate it; but Mr Kirwan fuppofes that one reafon of this variety is, that it is exceeding hard to hit the true point of faturation. Allowing 66 grains to be the quantity required, then 100 grains of perfectly dry common falt contain nearly 35 grains of real acid, 53 of alkali, and 13 of water; but 100 grains of the cryftallized falt lofe five by evaporation; fo that 100 grains of thefe cryftals contain 33.3 of acid, 50 of alkali, and 16.7 of water.

433 By marine acid.

The proportion of fixed air, alkali, and water, was thus inveftigated: 200 grains of thefe cryftals were diffolved in 240 of water; the folution was faturated by fuch a quantity of fpirit of nitre as contained 40 of pure nitrous acid; whence it was inferred that thefe 200 grains of falt of foda contained 70 of pure alkaline falt. The faturated folution weighed 40 grains lefs than the fum of its original weight, and that of the fpirit of nitre added to it; confequently it loft 40 grains of fixed air. The remainder of the original weight of the cryftals therefore muft have been water, *viz.* 90 grains. Confequently 100 grains of thefe cryftals contained 35 of alkali, 20 of fixed air, and 45 of water. This proportion differs confiderably from that affigned by Mr Bergman and Lavoifier, which our author imputes to their having made ufe of foda recently cryftallized; but Mr Kirwan's had been made for fome months, and probably loft much water and fixed air by evaporation, which altered the proportion of the whole. According to the calculations of Bergman and Lavoifier, 100 grains of this alkali take up 80 of fixed air. The fpecific gravity of the cryftallized mineral alkali, weighed in ether, found to be 1.421.

434 Proportion of fixed air, alkali, and water, inveftigated by this faturation.

435 Differences with M. Bergman and Lavoifier accounted for.

The proportion of the different ingredients in volatile alkalies can only be had from the experiments lately made by Dr Prieftley concerning alkaline air. He informs us, that $\frac{6}{10}$ of a meafure of this, and one meafure of fixed air, faturate one another. Then, fuppofing the meafure to contain 100 cubic inches, 185 cubic inches of alkaline air take up 100 of fixed air; but 185 cubic inches of alkaline air weigh at a medium 42.55 grains, and 100 cubic inches of fixed air weigh 57 grains; therefore 100 grains of pure volatile alkali, free from water, take up 134 of fixed air.

436 Proportions of ingredients in volatile alkalies.

On expelling its aerial acid from a quantity of this volatile alkali in a concrete ftate, and formed by fublimation, he found, that 53 grains of it were fixed air: according to the preceding calculation, 100 grains of it fhould contain 39.47 of real alkali, and 7.53 of water, the reft being fixed air.—On faturating a quantity with the vitriolic, nitrous, and marine acids, 100 grains of the mere alkali were found to take up 106 of mere vitriolic acid, 115 of the nitrous, and 130 of the marine acid. The fpecific gravity of the volatile alkali

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alkali weighed in ether (B) was 1.4076. The proportion of water in the different ammoniacal salts could not be found on account of their volatility; but was supposed to be very small, as both volatile alkali and fixed air crystallize without the help of water when in an aerial state.

437 Experiments on calcareous earth.

In making experiments on calcareous earth, it was first dissolved in nitrous acid; and after allowing for the loss of fixed air and water, 100 grains of the pure earth was found to take up 104 of nitrous acid; but only 91 or 92 of mere vitriolic acid were required to precipitate it from the nitrous solution.

438 Quantity of marine acid saturated by this earth.

Of the marine acid 100 grains of the pure calcareous earth require 112 for their solution. The liquor at first is colourless, but acquires a greenish colour by standing.

439 Proportion of ingredients in natural gypsum;

Natural gypsum varies in its proportion of acid, water, and earth; 100 grains of it containing from 32 to 34 of acid and likewise of earth, and from 26 to 32 of water. The artificial gypsum contains 32 of earth, 29.44 of acid, and 38.56 of water. When well dried, it loses about 24 of water; and therefore contains 42 of earth, 39 of acid, and 19 of water, *per* hundred.

440 In nitrous selenite;

Nitrous selenite (solution of calcareous earth in nitrous acid) carefully dried, contains 33.28 of acid, 32 of earth, and 34.72 of water.

441 In marine selenite.

The same quantity of marine selenite (solution of calcareous earth in marine acid), well dried, in such a manner as to lose no part of the acid, contain of the latter 42.56, of earth 38, and of water 19.44.

442 Calcined magnesia will not dissolve in acids without heat.

Magnesia, when perfectly dry and free from fixed air, cannot be dissolved in any of the acids without heat. Even the strongest nitrous acid did not act upon it in 24 hours in the temperature of the atmosphere; but in a heat of 180°, the mineral acids, diluted with four, or even six, times their quantity of water, had a very sensible effect upon it; but the quantity of acid dissipated by heat rendered it impossible to ascertain how much was necessary for solution, except by precipitation after it had been dissolved. For this purpose the caustic vegetable alkali was employed; by which it appeared that 100 grains of pure magnesia take up 125 of mere vitriolic acid, 132 of the nitrous, and 140 of the marine. All of these solutions appeared to contain something gelatinous; but none of them reddened vegetable blues; and that in the marine acid became greenish on standing for some time.

443 Proportion of the ingredients in common Epsom salt;

An hundred grains of perfectly dry Epsom salt contain 45.67 of mere vitriolic acid, 36.54 of pure earth, and 17.83 of water. Solution of common Epsom salt, however, reddens vegetable blues, and therefore contains an excess of acid.

444 In nitrous Epsom.

A like quantity of nitrous Epsom, well dried, contains 35.64 of acid, 27 of pure earth, and 37.36 of water.

445 Cannot be found in marine Epsom.

The solution of marine Epsom cannot be tolerably dried without losing much of its acid together with the water. The specific gravity of this earth is 2.3296.

446 Earth of alum contains a great quantity of fixed air.

Most writers on chemistry have said that earth of alum contains scarce any fixed air; but Mr Kirwan found that it contained no less than 26 *per cent.* though it had been previously kept red-hot for half an hour. It dissolved with a moderate effervescence in acids until the heat was raised to 220°; after which the solution was found to have lost weight in the proportion abovementioned.

447 Quantity of ingredients in alum.

An hundred grains of this earth, deprived of the fixed air, require 133 of the pure vitriolic acid to dissolve them. The solution was made in a very dilute spirit of vitriol, whose specific gravity was 1.093, and in which the proportion of acid to the water was nearly as 1 to 14. It contained a slight excess of acid, turning the vegetable blues to a brownish red; but it crystallized when cold, and the crystals were of the form of alum. Our author, therefore, is of opinion, that this is the true proportion of acid and earth to be used in the formation of that salt, though there was not water enough to form large crystals.

448 This salt always contains an excess of acid.

Perceiving that the liquor contained an excess of acid, more earth was added; but thus it was found impossible to prevent it from tinging vegetable blues of a red colour until a precipitation was formed: and even when this was the case, though one part of the salt fell in the form just mentioned, yet the rest would still redden vegetable blues as before; though here our author doubts whether this be a mark of acidity. An hundred grains of alum, when dried, contain 42.74 of acid, 32.14 of earth, and 25.02 of water; but crystallized alum loses 44 *per cent.* by desiccation: therefore 100 grains of it contain 23.94 of acid, and 58.06 of water.

449 Proportion of pure earth of alum taken up by nitrous acid;

An hundred grains of this pure earth take up, as near as can be judged, 153 of pure nitrous acid. The solution still reddened vegetable blues; but after the above quantity of earth was added, an insoluble salt began to precipitate. The solution, when cold, became turbid, and could not be rendered quite clear by 500 times its quantity of water.

450 By marine acid.

An hundred and seventy-three grains of pure marine acid are required for the dissolution of 100 grains of earth of alum, but the liquor still reddened vegetable blues. After this an insoluble salt was formed; but it is difficult to ascertain the beginning of its formation precisely both in this and the preceding cases. The specific gravity of pure argillaceous earth, containing 25 *per cent.* of fixed air, is 1.9901.

451 Experiments on metals.

In the experiments made by our author on metals, the acids employed were so far dephlogisticated as to be colourless; the metals were for the most part reduced to filings, or to fine powder in a mortar.

452 Best method of dissolving them.

They were added by little and little to their respective menstrua; much more being thus dissolved than if the whole had been thrown in at once, and the solution was performed in glass vials with bent tubes.

453 Proportion of iron taken up by the vitriolic acid.

An hundred grains of bar-iron, in the temperature of 56°, require for their solution 190 grains of the real acid, whose proportion to that of the water, with which it should be diluted, is as 1 to 8, 10, or 12. It would act on iron, though its proportion were greater or lesser, though not so vigorously; but by applying a heat of 200° towards the end, 123 grains of

(B) The fixed and volatile alkalies were weighed in ether on account of their great solubility in water.

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of real acid would be sufficient. The air produced by this solution is entirely inflammable, and generally amounts to 115 cubic inches.

454 Quantity of inflammable air produced.

By the assistance of a strong heat, iron is also soluble in the concentrated vitriolic acid, though in smaller quantity; and instead of inflammable air, a large quantity of vitriolic air is produced, and a little sulphur is sublimed towards the end. The reason of this is, that the concentrated vitriolic acid, containing much less specific fire than the dilute kind, cannot expel the phlogiston in the form of inflammable air (which absorbs a vast quantity of fire), but unites with it when further dephlegmated by heat, and thus forms both vitriolic air and sulphur. An hundred grains of iron dissolved without heat afford more than 400 of vitriol; and 100 grains of vitriol, when crystallized, contain 25 of iron, 20 of real acid, and 55 of water. When calcined nearly to redness, these crystals lose about 40 *per cent.* of water.

455 Why vitriolic air is produced by dissolving iron in concentrated oil of vitriol.

456 Solution of the calces of iron in vitriolic acid.

The calces of iron are soluble in the vitriolic acid according to the quantity of phlogiston they contain; the more phlogisticated being more readily soluble, and those which are dephlogisticated less so. The latter not only require more real acid for their solution, but afford only a thick liquor or magma by evaporation, instead of crystals like the others. Hence also solutions of iron, when newly made, diminish, and consequently phlogisticate, the superincumbent air by their gradual emission of phlogiston; at the same time that the calx, becoming more and more dephlogisticated, gradually falls to the bottom, unless more acid be added to keep it in solution.

457 That of the dephlogisticated calces of iron refuses to crystallize.

458 Proportion of iron dissolved in nitrous acid.

An hundred grains of iron require for their solution in nitrous acid 142 grains of real acid, so diluted that its proportion to water should be as 1 to 13 or 14; and when this last proportion is used, the heat of a candle may be employed for a few seconds, and the access of common air prevented. Thus about 18 cubic inches of nitrous air are produced, the rest being absorbed by the solution, and no red vapours appear. But if the proportion of acid and water be as 1 to 8 or 10, a much greater quantity of metal will be dephlogisticated by the application of heat, though very little of it be held in solution Thus, from 100 grains of iron Mr Kirwan has obtained 83.87 cubic inches of nitrous air; and by distilling the solution, a still greater quantity may be obtained which had been absorbed. The reason that nitrous solutions of iron or other metals yield no inflammable air is, because this acid has less affinity to water, and more to phlogiston, than the vitriolic, and likewise contains much less fire than either that or the marine (see n° 278); and therefore unites with phlogiston, instead of barely expelling it. Hence also the vitriolic acid, though united with 30 times its weight of water, will still visibly act on iron, and separate inflammable air in the temperature of 55°; whereas nitrous acid, diluted with 15 times its weight of water, has no perceptible effect on the metal in that temperature. The calces of iron, if not too much dephlogisticated, are also soluble in the nitrous acid.

459 Quantity of nitrous air obtained from this solution.

460 Why no inflammable air is here produced.

461 Vitriolic acid acts on iron in a much more dilute state than nitrous.

462 Iron taken up by the marine acid.

Two hundred and fifteen grains of real marine acid are required for the solution of 100 grains of iron. When the proportion of water to the acid is as four to one, it effervesces rather too violently with the metal; and heat is rather prejudicial, as it volatilizes the acid. No marine air flies off; and the quantity of inflammable air is exactly the same as with diluted vitriolic acid. The calces of iron are also soluble in marine acid, and may be distinguished by their reddish colour when precipitated by fixed alkalies, while the precipitates of the metal are greenish.

463 Calces of iron precipitated of a reddish colour from their solution in marine acid.

An hundred and eighty-three grains of real vitriolic acid are required to dissolve an hundred grains of copper; the proportion of acid to that of water being as 1 to 1.5, or at least as 1 to 1.7; and a strong heat must also be applied. Mr Kirwan says he never could dissolve the whole quantity of copper; but to dissolve a given quantity of it, a still greater heat must be employed in the proportion of 28 to 100; but this residuum also is soluble by adding more acid. Copper dephlogisticated in this manner is soluble by adding warm water to the mass.

464 Proportion of copper dissolved by vitriolic acid.

By treating 128 grains of copper in this manner, we obtain 11 cubic inches of inflammable air and 65 of vitriolic acid air. When inflammable air was obtained, however, our author tells us the acid was a little more aqueous. The reason why copper cannot be dephlogisticated by dilute vitriolic acid, or even by the concentrated kind without the assistance of heat, is its strong attraction to phlogiston, and the great quantity it contains.

465 Inflammable and vitriolic acid air obtained from solution of copper in vitriolic acid.

466 Why this metal cannot be acted upon by dilute vitriolic acid.

An hundred grains of vitriol of copper contain 27 of metal, 30 of acid, and 43 of water; 28 of which last are lost by evaporation or slight calcination. An hundred grains of copper, when dissolved, afford 373 of blue vitriol.

467 Proportion of ingredients in blue vitriol.

An hundred grains of copper require 130 of pure nitrous acid for their dissolution. If the acid be so far diluted that its proportion of water be as 1 to 14, the assistance of heat will be necessary, but not otherwise. This solution affords $67\frac{1}{4}$ inches of nitrous air.—The calces of copper are soluble in the nitrous acid.

468 Quantity of copper dissolved by nitrous acid.

A like quantity of this metal requires 1190 grains of real marine acid, as well as the assistance of a moderate heat, to dissolve them; the proportion of water being as $4\frac{1}{2}$ to 1. By employing a greater heat, more of the acid will be requisite, as much more will be dissipated: the concentrated acid acts more vigorously.—Calces of copper are likewise soluble in the marine acid, though less easily than in the nitrous.

469 In marine acid.

470 Action of the vitriolic acid in tin.

The vitriolic acid dissolves tin but in small quantity; an hundred grains of the metal requiring for their solution 872 of real acid, whose proportion to water should not be less than 1 to 0.9. A strong heat is also required. When the action of the acid has ceased, some hot water should be added to the turbid solution, and the whole again heated. The metal is soluble in a more dilute acid, but not in such quantity.—The solution abovementioned affords 70 cubic inches of inflammable air.—The calces of tin, excepting that precipitated from marine acid by fixed alkalies, are insoluble in the vitriolic acid.

471 Inflammable air obtained from the solution.

472 Tin dissolved in nitrous acid.

An hundred grains of tin require 1200 of real nitrous acid; whose proportion of water should be at least 25 to 1, and the heat employed not exceeding 60°. The quantity of air afforded by such solution is only 10 cubic inches, and it is not nitrous. The solution

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lution is not permanent; for in a few days it depoſites a whitiſh calx, and in warm weather burſts the vial. The calces of tin are inſoluble in this acid.

473
In marine acid.

Four hundred and thirteen grains of pure marine acid are required to diſſolve 100 grains of tin, the proportion of water being as $4\frac{1}{2}$ to 1. The aſſiſtance of a moderate heat is alſo required. About 90 cubic inches of inflammable, and 10 of marine air, are afforded by the ſolution; but the calces of tin are nearly inſoluble in this acid.

474
Lead with vitriolic acid.

An hundred grains of lead require 600 grains of real vitriolic acid for their ſolution, the proportion being not leſs than 1 of acid to $\frac{7}{10}$ of water; and it will ſtill be better if the quantity of water be leſs: for which reaſon, as in copper, a greater quantity of metal ſhould be employed than what is expected to be diſſolved. A ſtrong heat is alſo requiſite; and hot water ſhould be added to the calcined maſs, though in ſmall quantity, as it occaſions a precipitation.—This metal is alſo ſoluble, but very ſparingly, in dilute vitriolic acid. Its calces are ſomething more ſoluble. An hundred grains of vitriol of lead, formed by precipitation, contain 73 of lead, 17 of real acid, and 10 of water.

475
Scarce ſoluble in dilute vitriolic acid.

476
With nitrous acid.

With ſpirit of nitre, 78 grains of real acid are required for the ſolution of 100 of lead, with the aſſiſtance of heat towards the end. The proportion of acid to that of water may be about 1 to 11 or 12. This ſolution produces but eight cubic inches of air, which is nitrous. The calces of the metal are ſoluble in this acid; but leſs ſo when much dephlogiſticated. An hundred grains of minium require 81 of real acid. An hundred grains of nitrous ſalt of lead contain about 60 of the metal.

477
With marine acid.

Six hundred grains of the real marine acid are required for the ſolution of 100 grains of lead; the ſpecific gravity of the acid being 1.141, though more would be diſſolved by a ſtronger acid.—The calces of lead are more ſoluble in this acid than the metal itſelf. An hundred grains of minium require 327 of real acid; but white lead is much leſs ſoluble. The ſame quantity of plumbum corneum, formed by precipitation, contain 72 of lead, 18 of marine acid, and 10 of water.

478
Silver with vitriolic acid.

An hundred grains of ſilver require 530 of real vitriolic acid to diſſolve them; the proportion of acid to water being not leſs than as 1 to $\frac{8}{10}$: and when ſuch a concentrated acid is uſed, it acts ſlightly even in the temperature of 60°; but a moderate heat is required in order to procure a copious ſolution. The calces of ſilver formed by precipitation from the nitrous acid with fixed alkalies are ſoluble even in dilute vitriolic acid without the aſſiſtance of heat. An hundred grains of vitriol of ſilver, formed by precipitation, contain 74 grains of metal, about 17 of real acid, and 9 of water.

479
With nitrous acid.

An hundred grains of the pureſt ſilver require for their ſolution 36 of nitrous acid, diluted with water in the proportion of one part of real acid to ſix of water, applying heat only when the ſolution is almoſt ſaturated. If the ſpirit be much more or much leſs dilute, it will not act without the aſſiſtance of heat. The laſt portions of ſilver thus taken up afford no air. Standard ſilver requires about 38 grains of real acid to diſſolve the ſame proportion of it; and the ſolution affords 20 cubic inches of nitrous air; whereas 100 grains of ſilver revived from luna cornea afford about 14.

480
Of the diſſolution of ſilver in marine acid.

Mr Kirwan has never been able to diſſolve ſilver in the marine acid, though Mr Bayen ſays he effected the diſſolution of three grains and a half of it by digeſtion ſome ſome days with two ounces of ſtrong ſpirit of ſalt. Newman informs us alſo, that leaf-ſilver is corroded by the concentrated marine acid. It is diſſolved, however, by the dephlogiſticated ſpirit of ſalt, as well as by the phlogiſticated acid when reduced to a ſtate of vapour. An hundred grains of luna cornea contain 75 of ſilver, 18 of acid and 7 of water.

481
Beſt kind of aqua regia for diſſolving gold.

Mr Kirwan found that kind of aqua regia to ſucceed beſt in the diſſolution of gold, which was prepared by mixing together three parts of the real marine acid with one of the nitrous acid. Both of them ought alſo to be as concentrated as poſſible; though, when this is the caſe, it is almoſt impoſſible to prevent a great quantity from eſcaping, as a violent efferveſcence takes place for ſome time after the mixture. Aqua regia made with common ſalt or ſal ammoniac and ſpirit of nitre, is much leſs aqueous than that proceeding from an immediate combination of both acids; and hence it is the fitteſt for producing cryſtals of gold. Very little air is produced by the ſolution of this metal, and the operation goes on very ſlow. It is, however, better promoted by allowing it ſufficient time, than by applying heat. An hundred grains of gold require for their ſolution 246 grains of real acid, the two acids being in the proportion abovementioned. Though ſoluble in the dephlogiſticated marine acid, it is only in very ſmall quantity, unleſs the acid be in a ſtate of vapour; for in its liquid ſtate it is too aqueous. In vitriolic and nitrous acids it is inſoluble, tho' the calces are ſomewhat ſoluble in the nitrous, more eaſily in the marine, but ſcarcely at all in the vitriolic acid. Mr Kirwan ſays, that gold in its metallic ſtate may be diffuſed through the concentrated nitrous acid, tho' not diſſolved in it; contrary to the opinion of other chemiſts, who have affirmed that a true diſſolution takes place.

482
Quantity of gold taken up by aqua regia.

483
Calces of gold ſoluble in the vitriolic and nitrous acids.

484
Gold cannot, according to Kirwan, be diſſolved in nitrous acid.

485
Mercury with vitriolic acid.

An hundred grains of mercury require for their ſolution 230 grains of real vitriolic acid, whoſe proportion to that of water is as 1 to $\frac{8}{10}$. A ſtrong heat is alſo requiſite, and the air produced is vitriolic. Precipitate *per ſe* is ſtill leſs ſoluble.—An hundred grains of vitriol of mercury, produced by precipitation, contain 77 of metal, 19 of acid, and 4 of water.

486
With ſpirit of nitre.

In ſpirit of nitre, 100 grains of mercury are diſſolved by 28 of real acid, whoſe proportion to the water it contains is as 1 to $1\frac{52}{100}$. In this acid the ſolution takes place without heat; but it may alſo be diſſolved in a much more dilute acid, provided heat be applied. About 12 cubic inches of air are produced when heat is not applied; but M. Lavoiſier found the produce much greater. This, ſays Mr Kirwan, was evidently cauſed by his uſing red or yellow ſpirit of nitre, which already contains much phlogiſton. Precipitate *per ſe* is much leſs eaſily diſſolved in the nitrous acid, which Mr Kirwan ſuppoſes to be owing to the attraction of the aerial acid.

2d 486
With marine acid.

The marine acid, in its common phlogiſticated ſtate, does not act on mercury, at leaſt in its uſual ſtate of concentration; though M. Homberg, in the Paris Memoirs for the year 1700, affirms, that he diſſolved it by ſeveral months digeſtion in this acid. When dephlogiſticated, it certainly acts upon it, though very



weakly

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weakly while in a liquid ſtate. Precipitate *per ſe* is alſo ſoluble in the marine acid with the aſſiſtance of heat. An hundred grains of corroſive ſublimate contain 77 of mercury, 16 of real acid, and ſix of water. The like quantity of mercurius dulcis contains 86 of metal and 14 of acid and water.

487 Zinc with vitriolic acid;

Zinc requires for its ſolution an equal quantity of real vitriolic acid, whoſe proportion to that of water may be as 1 to 8, 10, or 12. Heat muſt be applied towards the end, when the ſaturation is almoſt completed. By the help of heat alſo this ſemimetal is ſoluble in the concentrated vitriolic acid, but a ſmall quantity of black powder remains in all caſes undiſſolved. An hundred cubic inches of inflammable air are produced. An hundred grains of vitriol of zinc contain 20 of zinc, 22 of acid, and 58 of water. The calces of zinc, if not exceedingly dephlogiſticated, are alſo ſoluble in this acid.

488 With nitrous acid.

An hundred and twenty-five grains of real nitrous acid, whoſe proportion to water is that of 1 to 12, are required for the ſolution of 100 grains of this ſemimetal, applying heat ſlightly from time to time. A concentrated acid diſſolves leſs of the metal, as a great quantitity of the menſtruum eſcapes during the effervescence. No nitrous air can be procured, the acid being partly decompoſed during the operation. The calces of zinc, if not too much dephlogiſticated, are likewiſe diſſolved by the nitrous acid.

489 Leſs metal diſſolved by concentrated than by diluted nitrous acid.

490 With marine acid.

An hundred grains of zinc, require for their diſſolution 210 grains of real marine acid, the proportion of it to the water being as 1 to 9. If a more concentrated ſpirit of ſalt be made uſe of, a conſiderable part of it will be diſſipated during the effervescence, and conſequently more will be required for the ſolution. The calces of zinc are alſo ſoluble in the marine acid.

491 Biſmuth ſcarce ſoluble in vitriolic acid.

Only three grains of biſmuth were diſſolved by 200 of oil of vitriol, whoſe ſpecific gravity was 1.863, though a ſtrong heat was uſed at the ſame time. A greater quantity was indeed ſlightly dephlogiſticated; but when the gravity of the acid was reduced to 1.200, only a ſingle grain of the metal was diſſolved by 400 of it. The calces of this ſemimetal are much more ſoluble. Four cubic inches of vitriolic air were afforded by the ſolution of three grains of biſmuth.

492 Quantity diſſolved in ſpirit of nitre.

In ſpirit of nitre, 100 grains of real acid are only required to diſſolve 100 grains of the metal. The proportion of water to the acid ought to be as 8 or 9 to 1; in which caſe a gentle heat may be applied. The ſolution affords 44 cubic inches of nitrous air. The calces of biſmuth are alſo ſoluble in this acid.—

493 Scarce ſoluble in marine acids.

Only three or four grains of it were diſſolved by 400 of marine acid, whoſe ſpecific gravity was 1.220.

2d 493 Nickel with vitriolic acid;

About four grains of nickel were diſſolved in an hundred of the concentrated vitriolic acid with the aſſiſtance of a ſtrong heat; but its calces are much more ſoluble.—An hundred grains of nickel require for their ſolution 112 of real nitrous acid, whoſe proportion to water is as 1 to 11 or 12. The product of nitrous air is 79 inches. The calces are alſo ſoluble. A moderate heat is neceſſary for the diſſolution of the metal; but a concentrated acid acts ſo rapidly, that much of it is diſſipated.—Only four or five grains of nickel are diſſolved by 200 of ſpirit of ſalt whoſe ſpecific gravity was 1.220. An acid of this degree of ſtrength acts without the aſſiſtance of heat, though a weaker acid requires it, and diſſolves ſtill leſs of the metal. The calces of nickel are alſo ſoluble with difficulty in this acid.

494 With nitrous acid.

495 With marine acid;

Four hundred and fifty grains of real vitriolic acid, whoſe proportion to water is not leſs than 1 to $\frac{7}{10}$, are required for the diſſolution of 100 grains of cobalt, aſſiſted by a heat of 270° at leaſt. A ſolution is obtained by pouring warm water on the dephlogiſticated maſs.—The calces of cobalt, however, are more ſoluble; ſo that even a dilute acid will ſerve.— In ſpirit of nitre, the like quantity of cobalt requires 220 grains of real acid, whoſe proportion to water is as 1 to 4; giving a heat of 180 towards the end.—The calces of the metal are ſoluble in the nitrous acid.— An hundred grains of ſpirit of ſalt, whoſe ſpecific gravity is 1.178, diſſolves, with the aſſiſtance of heat, two grains and a half of cobalt; and a greater quantity will be diſſolved by an acid more highly concentrated.—The calces of cobalt are more ſoluble.

496 Cobalt with vitriolic acid;

497 With ſpirit of nitre;

498 With ſpirit of ſalt;

499 Regulus of antimony with vitriolic acid;

An hundred grains of regulus of antimony require for their ſolution 725 grains of real vitriolic acid, whoſe proportion to water is as 1 to $\frac{7}{10}$, aſſiſted by a heat of 400°. A large quantity of regulus ſhould be put into the acid; and the reſulting ſalt requires much water to diſſolve it, as the concentrated acid lets fall much when water is added to it. A leſs concentrated acid will likewiſe diſſolve this ſemimetal, but in ſmaller quantity. The calces of antimony, even diaphoretic antimony, are ſomewhat more ſoluble. Nine hundred grains of real nitrous acid are required for the ſolution of 100 grains of regulus; the proportion of acid to the water of the ſolvent being as 1 to 12, and aſſiſted by an heat of 110°; but the ſolution becomes turbid in a few days. The calces are much leſs ſoluble in this acid.—Only one grain of the regulus is diſſolved by 100 of ſpirit of ſalt, whoſe ſpecific gravity was 1.220, with the aſſiſtance of a ſlight heat; and that which is only 1.178 diſſolves ſtill leſs; but Mr Kirwan is of opinion that the concentrated acid would, in a long time, and by the aſſiſtance of a gentle heat, diſſolve much more. The calces diſſolve more eaſily in the marine acid.

500 With nitrous acid.

501 Scarce ſoluble in the marine acid.

502 Regulus of arſenic with vitriolic acid.

Eighteen grains of regulus of arſenic are diſſolved in a heat of 250° by 200 grains of real vitriolic acid, whoſe ſpecific gravity is 1.871. About ſeven of theſe parts cryſtallize on cooling, and are ſoluble in a large quantity of water. The calces of arſenic are more ſoluble in this acid.—An hundred and forty grains of real nitrous acid are requiſite for the ſolution of 100 grains of regulus of arſenic; the proportion of acid to the water being as 1 to 11. The ſolution affords 102 cubic inches of nitrous air, the barometer being at 30 and the thermometer at 60. Calces of arſenic are likewiſe ſoluble in this acid.

503 With nitrous acid;

504 With ſpirit of ſalt.

An hundred grains of ſpirit of ſalt, whoſe ſpecific gravity is 1.220, diſſolve a grain and an half of regulus of arſenic; but the marine acid, in its common ſtate, that is, when its gravity is under 1.17, does not at all affect it. The arſenical calces are leſs ſoluble in this than in the vitriolic or nitrous acids.

### § 3. *Of the Quantity of Phlogiſton contained in different Subſtances.*

Having gone through all the various baſes with which acids are uſually combined, and aſcertained the quantity

Quantity of Phlogiston in different Substances.

quantity of different ingredients contained in the compounds resulting from their union, we ought next to give an account of our author's experiments on phlogiston; but as his sentiments on that subject are taken notice of elsewhere, we shall content ourselves with briefly mentioning the very ingenious methods by which he discovers the quantities of it contained in various kinds of air and in sulphur.

505 Quantity of phlogiston contained in nitrous air.

Having proved that inflammable air, in its concrete state, and phlogiston are the same thing, Mr Kirwan proceeds to estimate the quantity contained in nitrous air in the following manner.

"An hundred grains of filings of iron, dissolved in a sufficient quantity of very dilute vitriolic acid, produced, with the assistance of heat gradually applied, 155 cubic inches of inflammable air; the barometer being at 29.5, and the thermometer between 50° and 60°. Now, inflammable air and phlogiston being the same thing, this quantity of inflammable air amounts to 5.42 grains of phlogiston.—Again, 100 grains of iron dissolved in dephlogisticated nitrous acid, in a heat gradually applied and raised to the utmost, afford 83.87 cubic inches of nitrous air. But as this nitrous air contains nearly the whole quantity of phlogiston which iron will part with (it being more completely dephlogisticated by this than any other means), it follows, that 83,87 cubic inches of nitrous air contain at least 5.42 grains of phlogiston. But it may reasonably be thought, that the whole quantity of phlogiston which iron will part with is not expelled by the vitriolic acid, but that nitrous acid may expel and take up more of it. To try whether this was really the case, a quantity of green vitriol was calcined until its basis became quite insipid; after which two cubic inches of nitrous air were extracted from 64 grains of this ochre; and consequently 100 grains, would yield 3.12 cubic inches of nitrous air. If 83.87 cubic inches of nitrous air contain 5.42 of phlogiston; then 3.12 cubic inches of this air contain 0.2 of phlogiston. The nitrous acid, therefore, extracts from 100 grains of iron two-tenths of a grain more phlogiston than vitriolic acid does. Therefore 83.87 cubic inches of nitrous air, containing nearly the whole phlogiston of the iron, have 5.62 of this substance. Hence 100 cubic inches of nitrous air contain 6.7 grains of phlogiston."

2d 505 Quantity of phlogiston in fixed air;

With regard to the quantity of phlogiston in fixed air, after proving at length that it is composed of dephlogisticated air united to the principle of inflammability, Mr Kirwan ascertains the quantity of the latter in the following manner: "Dr Priestley, in the fourth volume of his Observations, p. 380, has satisfactorily proved, that nitrous air parts with as much phlogiston to common air, as an equal bulk of inflammable does when fixed in the same proportion of common air. Now, when inflammable air unites with common air, its whole weight unites to it, as it contains nothing else but pure phlogiston. Since, therefore, nitrous air phlogisticates common air to the same degree that inflammable air does, it must part with a quantity of phlogiston, equal to the weight of a volume of inflammable air, similar to that of nitrous air. But 100 cubic inches of inflammable air weigh three grains and a half; therefore 100 cubic inches of nitrous air part with 3.5 grains of phlogiston, when they communicate their phlogiston to as much common air as will take it up. In this process, however, the nitrous air does not part with the whole of the phlogiston it contains, as appears by the red colour it constantly assumes when mixed with common or dephlogisticated air; which colour belongs to the nitrous acid, combined with the remainder of its phlogiston, whence the acid produced is always volatile.

"One measure of the purest dephlogisticated air and two of nitrous air occupy but $\frac{3}{100}$ of one measure, as Dr Priestley has observed. Suppose one measure to contain 100 cubic inches, then the whole, very nearly, of the nitrous air will disappear (its acid uniting to the water over which the mixture is made), and 97 cubic inches of the dephlogisticated air, which is converted into fixed air by its union with the phlogiston of the nitrous air; therefore 97 cubic inches of dephlogisticated air take up all the phlogiston which 200 cubic inches of nitrous air will part with; and this we have found to be seven grains: therefore a weight of fixed air equal to that of 97 cubic inches of dephlogisticated air, and 7 of phlogiston, will contain seven grains of the latter. Now, 97 cubic inches of dephlogisticated air weigh 40.74 grains; to which adding 7, we have the whole weight of the fixed air,=47.74 grains,=83.755 cubic inches; and consequently 100 cubic inches of fixed air contain 8.357 grains of phlogiston, the remainder being dephlogisticated air. An hundred grains of fixed air, therefore, contain 14.661 of phlogiston, and 85.339 of elementary or dephlogisticated air. Hence also 100 cubic inches of dephlogisticated air are converted into fixed air by 7.2165 grains of phlogiston, and will be then reduced to the bulk of 86.34 cubic inches.

506 In vitriolic acid air.

To find the quantity of phlogiston in vitriolic acid air, our author pursued the following method.

1. He found the quantity of nitrous air afforded by a given weight of copper, when dissolved in the dephlogisticated nitrous acid, and by that means how much phlogiston it parts with.

2. He found the quantity of copper which a given quantity of the dephlogisticated vitriolic acid could dissolve; and observed, that it could not entirely saturate itself with copper without dephlogisticating a further quantity which it does not dissolve.

3. He found how much it dephlogisticates what it thoroughly dissolves, and how much it dephlogisticates what it barely calcines.

4. How much inflammable air a given quantity of copper affords when dissolved in the vitriolic acid to the greatest advantage.

5. He deducts from the whole quantity of phlogiston expelled by the vitriolic acid the quantity of it contained in the inflammable air; the remainder shows the quantity of it contained in the vitriolic acid air.

The conclusion deduced from experiments, conducted after this manner is, that 100 cubic inches of vitriolic air contain 6.6 grains of phlogiston, and 71.2 grains of acid; and 100 cubic inches of this air weighing 77.8 grains, 100 of it must contain 8.48 grains phlogiston, and 91.52 of acid.

507 Quantity of phlogiston in Sulphur.

To find the quantity of phlogiston in sulphur, Mr Kirwan proposed to estimate that of the fixed air produced during its combustion. For this purpose he firmly tied and cemented to the open top of a glass bell a large bladder, destined to receive the air expanded by combustion, which generally escapes when this

Quantity of Phlogiston in different Substances

this precaution is not used. Under this bell, containing about 3000 cubic inches of air, a candle of sulphur, weighing 347 grains, was placed; its wick, which was not consumed, weighing half a grain. It

508 Proper method of burning sulphur.

was supported by a very thin concave plate of tin, to prevent the sulphur from running over during the combustion; and both were supported by an iron wire fixed in a shelf in a tub of water. As soon as the sulphur began to burn with a feeble flame, it was covered with the bell, the air being squeezed out of the bladder. The inside of the bell was soon filled with white fumes, so that the flame could not be seen; but in about an hour after all the fumes were thoroughly subsided, and the glass become cold, as much water entered the bell as was equal to 87.2 cubic inches; which space our author concludes to have been occupied by fixed air, and which must have contained 7.287 grains of phlogiston. The candle of sulphur being weighed was found to have lost 20.75 grains; therefore 20.75 grains of sulphur contain 7.287 of phlogiston, besides the quantity of phlogiston which remained in the vitriolic air. This air must have amounted to 20.75—7.287=13.463 grains, which, as already shown, contain 1.41 grains of phlogiston. Therefore the whole quantity of phlogiston in 20.75 grains of sulphur is 8.428; of consequence 100 grains of sulphur contain 59.39 of vitriolic acid, and 40.61 of phlogiston.

509 Quantity of phlogiston in marine acid air.

The quantity of phlogiston contained in marine acid air was found by the following method.—Eight grains of copper dissolved in colourless spirit of salt afforded but 4.9 inches of inflammable air; but when the experiment was repeated over mercury, 91.28 cubic inches of air were obtained. Of these only 4.9 cubic inches were inflammable; and consequently the remainder, 86.38 inches, were marine air, weighing 56.49 grains.—Now as spirit of salt certainly does not dephlogisticate copper more than the vitriolic acid does, it follows, that these 4.9 cubic inches of inflammable air, and 86.38 of marine air, do not contain more phlogiston than would be separated from the same quantity of copper by the vitriolic acid; and since 100 grains of copper would yield to the vitriolic acid 4.32 grains of phlogiston, 8.5 grains of copper would yield 0.367 grains of phlogiston. This therefore is the whole quantity extracted by the marine acid, and contained in 91.28 cubic inches of air; and, deducting from this the quantity of phlogiston contained in 4.9 cubic inches of inflammable air=0.171 grains, the remainder, *viz.* 0.367—0.171=0.196, is all the phlogiston that can be found in 86.38 cubic inches of marine air. Then 100 cubic inches of it contain but 0.227 of a grain of phlogiston, 65.173

510 Why marine acid acts so weakly.

grains being acid.—Hence we see why it acts so feebly on oils, spirit of wine, *&c.* and why it is not dislodged from any basis by uniting with phlogiston, as the vitriolic and nitrous acids are, its affinity to it being inconsiderable.

## § 4. *Remarks on the Doctrines of the Quantity and specific Gravity above delivered.*

2d 510 Mr Keir's objections to Kirwan's doctrines.

To this doctrine of the specific gravity and quantity of acid contained in different substances, Mr Keir has made several objections. 1. Mr Kirwan supposes, that marine acid gas is the pure and solid marine acid divested of all water and other matter. Its apparent dryness in this respect, however, is no argument that it really contains no water; for water itself, reduced to a state of vapour, possesses no moistening property. There is great reason to believe that water is a constituent part of some gases, and it is certain that all of them are capable of holding it in solution. As moist materials, therefore, are employed in the preparation of marine acid air, there seems no reason to believe, that in any way in which Mr Kirwan could obtain it, there was reason to suppose it perfectly free of water; in which case the density of the acid would be greater, and its quantity smaller than he supposes.

Remarks on the former Doctrines.

2. A considerable part of the density of the acid absorbed in the experiment, probably arose from the condensation which always accompanies the union of a concentrated acid with water. Mr Kirwan allows this to be the case with the nitrous and vitriolic acids, but thinks it too inconsiderable to deserve notice in the marine. His reasoning, however, does not appear satisfactory, or his experiments on the subject conclusive. He observes, that the length of time taken up in effecting an union between the marine gas and water, is no argument against their attracting one another strongly when once united; and it is certain that part of this acid gas is very quickly absorbed by water. He also finds fault with his accuracy in calculation; and asserts, that if matters are fairly stated, the real density of the marine acid gas will be considerably less than Mr Kirwan makes it.

3. A great obstacle even to an approximation towards the real density of the acid, arises from the condensation which the water, as well as the acids, must suffer in the process: and in this case, where a general condensation takes place, he asks, "How shall we determine the part of the condensation that belongs to the water, and the part that the acid sustains?" This, with other considerations, makes Mr Keir "doubt of the possibility of solving the question concerning the actual density of pure and solid acids." The investigation of the question, indeed, he does not consider as a matter of great consequence, as every useful application may be obtained, by first investigating the comparative strengths of different portions of the same acid rendered more or less dilute; and then by finding out the strength of the vitriolic, nitrous, and marine acids of known densities, so that they may be compared together. "Homberg (says he) has the merit of making the first essay towards this investigation. Bergman and Wenzal have supplied the defect of Homberg, by taking into consideration the gas united with alkaline substances; and Mr Kirwan, by using determinate quantities of acid liquors of known densities, has considerably improved the method of Bergman: and whoever succeeds these able chemists in this inquiry, may avail himself greatly of their labours, particularly those of Mr Kirwan." He concludes with stating the results of the inquiries made by the chemists abovementioned; on which he makes the following remarks.

3d 510 Great differences in the calculations of different authors.

"The discordancy of these results is very striking, and gives but an humiliating representation of the precision of our present knowledge in chemistry. A great part of the difference arises undoubtedly from the different views in which these authors considered the dryness or purity of the acids. Mr Kirwan, as we have seen, endeavoured to find their density and quantity in

a

Remarks on the former Doctrines.

a state of perfect dryness and purity; which he supposed to exist in the marine acid gas: with which he compared and inferred the densities and quantities of the nitrous and vitriolic acids, upon the supposition that equal quantities of these several acids are saturated by a given weight of fixed alkali. Besides the uncertainty of his principles, from which he deduces the density and quantity of the marine acid, his applications from thence to deduce the densities of the pure nitrous vitriolic acids, being founded on the above supposition, must partake of its defects. The alkali which he happened to fix on as the standard by which he compared the strengths of the different acid liquors, in order to determine the quantity of real acid they contained, and thence to determine their density in a solid state, was the fixed vegetable. Having found that 100 grains of his real marine acid could saturate 215 grains of this alkali, he infers, that the same proportion is applicable to the other acids: and accordingly we find that 100 grains of each of the pure and real mineral acids are saturated by an equal quantity, *viz.* 215 grains of this alkali. But if we examine the other columns of his table, we shall at once see, that, in other substances soluble by acids, this equality does not exist; and that every such substance has a ratio peculiar to itself, with respect to the proportions of these acids necessary for its saturation. It is evident, therefore, that if Mr Kirwan had fixed on the mineral alkali, the volatile alkali, lime, or any other substance, as a standard, instead of vegetable alkali, his determination of the densities of the real vitriolic and nitrous acids would have been different; and as no reason can be assigned why the vegetable alkali or any other substance should have the prerogative over the rest, it is obvious that there can be no such general standard, but that each substance possesses solely the capacity of determining the proportions of the several acids necessary for its saturation.

"The other chemists were contented to consider as the pure and dry acid, that which actually remains in the neutral salt, after this has been rendered as dry as possible by exposure to a red heat: and having made their alkalies as dry as they could, they supposed these alkalies to retain the same weight in the dried neutral salt; and that the augmentation of the weight gained by the alkali during the formation of the neutral salt showed the weight of the dry acid. The uncertainty which affects this method arises from the different capacities which different neutral salts may possess of retaining more or less water, either as a constituent part of the dry salt, or merely by the strength of adhesion or affinity. Nevertheless, this method being founded solely on experiment, without any theoretical inductions, seems to furnish some approximation, not perhaps of the absolute quantity of the acids in their driest possible state, but of the acids as they actually exist in these salts comparatively with each other. Though the disagreements between Bergman's and Wenzel's results are little in comparison of the difference between them and Kirwan's, yet as their experiments were made nearly in the same manner, and upon the same grounds, there seems to be sufficient reason to wish for a careful repetition of their experiments, or of others with the same view, and less liable to objections.

"The only difference in the methods employed by these two celebrated chemists consisted in the mode of saturation. Bergman probably used the common method, but Wenzel employed a very peculiar one. He added to his alkali a greater quantity of acid than was necessary for the saturation; and after the alkali was dissolved, he added a lump of zinc, or of oyster-shell, in order to saturate completely the superfluous acid. By observing how much of the zinc or oyster-shell the acid dissolved, and knowing how much of these substances was soluble in his acid by former experiments, he inferred the quantity of acid left for the saturation of the alkali. Having thus ascertained the quantity necessary to saturate the alkali, he mixed together the proper proportions of these, and formed his neutral salt by evaporating the mixture and drying the salt with a red heat. Perhaps the difference in the results obtained by these two chemists might arise from their different modes of saturation. The common method of ascertaining the point of saturation by means of litmus or other blue vegetable juices, appears sufficiently exact, is simpler, and therefore preferable to that used by Wenzel.

"The standard for comparing the strengths of acids, and likewise of alkalies with one another, may be either an acid or an alkaline substance; and if we had one of each, the proportion of whose quantities requisite for their mutual saturation were well ascertained, the conveniency in making the experiments would be obvious, and the certainty greater. Alkaline, and the earthy substances that are soluble in acids, are seldom pure enough for this purpose. They generally contain quantities, which are not constant, of fixed air, siliceous earth, magnesia, neutral salts, and inflammable matter, which render any of those that are commonly met with unfit for the purpose without a very skilful and careful purification. The chemists who have made experiments to determine the proportions of acids and alkalies requisite for each other's saturation, have scarcely been explicit enough in explaining the means of purifying the alkalies which they employed: for those in commerce are quite uncertain in strength and purity: and as to the general rules for making allowances for any heterogeneous substances they may contain, they are quite inapplicable to delicate experiments. No other method seems proper for ascertaining the purity of alkalies but that of crystallization: of which both the vegetable and mineral alkalies are susceptible, especially the latter, which on account of its being more easily reducible into crystals, is therefore preferable. These alkaline crystals, however, are not fit to be used as a standard, because they either are apt to be sufficiently dried, or, upon exposure to air, to lose a part of the water of their crystallization, and to fall into powder. Even if they should be taken, as is possible with due care, at the exact state of dry but entire crystals, another uncertainty arises from a property which seems to be common to them all, namely, that of retaining a greater or smaller quantity of water, according to the degree of heat in which they were crystallized; the colder the weather the greater quantity of water entering into the composition of the crystals. It seems possible, however, to make a pretty accurate standard of mineral alkali in the following manner: Let the alkali be purified by repeated solution 510

4th Mr Keir's method of preparing an alkaline standard.

Remarks on the former Doctrines.

tion and cryſtallization, uſing only ſuch as are formed firſt, and rejecting the remaining liquors. Let the pure cryſtals be expoſed to a dry air until they have completely effloreſced or fallen into a dry white powder; which alteration may be facilitated by bruiſing the cryſtals and changing the ſurface of the powder. Let this powder be then expoſed for a certain and determinate time to a conſtant heat, as that of boiling water for 12 hours; letting the ſurface expoſed be in ſome given proportion, ſuppoſe of a ſquare inch to an ounce of the powder of cryſtals, and let it be ſtirred every two hours. When thus dried, let them be put while hot into a bottle, and well ſtopped. This powder I have found to be an uniform and conſtant ſtandard for aſcertaining the ſtrength of acids; and alſo, by compariſon by means of acids, of other alkaline ſubſtances."

With regard to an acid ſtandard, our author recommends oil of vitriol; which, he ſays, as it comes from the hands of the Britiſh manufacturers, is of the ſpecific gravity of about 1.846, but ſoon becomes weaker, unleſs carefully kept from the external air; and in general he rates it at 1.844. One part of this acid mixed with nine of water, is of a very convenient ſtrength for uſe; and as every ten grains of the mixture contain one of the ſtandard acid, the computations are thus rendered eaſy: and by theſe ſtandards, the ſtrength of all acids, alkalies, and ſubſtances ſoluble in acids, may be meaſured and compared together.

5th 510 His method of finding the ſpecific gravity of different liquors.

To determine the ſpecific gravity of liquors with accuracy, our author recommends the method of weighing them in a phial fitted with a glaſs-ſtopper, which can only enter a certain length into the neck. In this way, he obſerves, no other inconvenience can enſue than the ſlight one, that the glaſs-ſtopper, by very frequent uſe, is apt to wear itſelf and the neck of the phial alſo; ſo that after a great number of experiments, it will at laſt diminiſh, in ſome meaſure, the capacity of the phial itſelf. This, however, is but very trifling, and may be corrected at any time. Mr Keir has beſides found, that after ſome hundreds of experiments, the error amounted only to one quarter of a grain in 101 grains.

"The methods hitherto practiſed (ſays he) for aſcertaining the quantities of acids and alkalies contained in neutral ſalts, ſeem to be liable to ſeveral objections beſides thoſe abovementioned, ariſing from the different proportions of water remaining in a neutral ſalt, after expoſure to a red-heat, which heat is alſo very indefinite. In boiling the ſaturated mixture of acid and alkali to dryneſs, and afterwards in expoſing this ſalt to a red-heat, it has been ſuppoſed that nothing but water is expelled; and ſome chemiſts, who have given the reſults, have alſo determined the weight of the alkali which enters into the neutral mixture, by evaporating to dryneſs an equal quantity of the alkaline ſolution which had been employed in the ſaturation, and weighing the dry ſolution, on the ſuppoſition that nothing is expelled but water. It is certain, however, that in the evaporation both of alkalies and neutral ſalts, a conſiderable portion of the ſaline matter is elevated towards the end, when the liquor becomes concentrated and acquires a degree of heat conſiderably above that of boiling water. The following method appears beſt for determining the relative quantities of acid and alkali, or other ſubſtance exiſting in neutral ſalts.

"To a given number of grains, ſuppoſe 100 of the ſtandard vitriolic acid, or to a proportionable quantity of any other acid, add as much of the alkali or other ſoluble ſubſtance as is requiſite for the ſaturation, and note the quantity required, which ſuppoſe to be 150 grains. We have thus a ſolution of the neutral ſalt, which is the object of the experiment; the quantities of acid and baſis contained in which are known, and the general proportion of the quantity of the acid to its baſis in the neutral ſalt determined, *viz.* as 100 to 150. The next thing to be diſcovered is the weight of the dry neutral ſalt contained in this ſolution, in order to know the proportion of the dry neutral ſalt to its acid and baſis. For this purpoſe, let a given quantity of the ſame neutral ſalt, either in the ſtate of cryſtals or dried to any given degree, be diſſolved in water. Let this ſolution be brought to the ſame denſity as the former, by adding water to the heavier of the two: then, by knowing the weight of each ſolution, and the quantity of dry neutral ſalt which was actually diſſolved in one of them, the quantity contained in the other may be deduced; and thence the quantities of ſtandard acid, or of other acid proportioned to it, and of the alkali employed, or other ſoluble ſubſtance contained in a given quantity of the neutral ſalt, are determined; alſo the quantity of water contained in the neutral ſalt, that is greater or leſs than what is contained in the quantity of acid employed, will be known, over and above any water that may have been contained in the alkali or other baſis of the neutral ſalt; the quantity of which water, if any, cannot be determined.

"By this method may be aſcertained the proportion of the acid, of the baſis, and of the neutral ſalt, to each other; not indeed the quantity of acid and of alkali deprived of all water, but the quantity of acid, equal in intenſity of acidity to a known portion of the ſtandard acid; and alſo the quantity of ſuch alkali or other ſoluble ſubſtance as was employed; the relative ſtrength of which is known from its ratio to the ſtandard acid."

6th 510 Objection to Kirwan's calculation of the quantity of phlogiſton in ſulphur.

The tranſlator of Wiegleb's Syſtem of Chemiſtry totally diſagrees with Mr Kirwan's calculation of the quantity of phlogiſton contained in ſulphur; but as his objection ſeems to ariſe rather from an inclination to the antiphlogiſtic doctrine that a real diſcuſſion of the ſubject, this can have but little weight. It is poſſible indeed that Mr Kirwan may have over-rated the quantity of phlogiſton this ſubſtance contains, which is indeed larger than that allowed by other chemiſts. "Brandt (ſays the tranſlator), who has been moſt generally followed, reckons it only at $\frac{1}{16}$; and it has always appeared to me, that the weight of phlogiſton in ſulphur is almoſt infinitely ſmall." His objection proceeds on a maxim which he thinks he has demonſtrated, *viz.* that ſulphur is compoſed, not of the vitriolic acid and phlogiſton, but of the *baſe* of vitriolic acid and phlogiſton. No experiments hitherto made, however, have been able to ſhow this baſe diſtinct from the acid; nor have we any reaſon to ſuppoſe that the increaſe of weight in the vitriolic acid above the ſulphur from

Earths.

from which it is produced, arises from any thing besides the accession of mere water, which the air parts with during the combustion. Hence, if the sulphur is burnt in a very moist air, the quantity of acid obtained will be four or five times the weight of the sulphur.

SECT. IV. *Earths.*

THESE are divided into five classes: 1. Absorbent, alkaline, or calcareous earths: 2. Argillaceous earths or clay: 3. The flinty: 4. The fusible earths: and, 5. The talks.

1. The first class comprehends all those that are capable of being converted into lime. They are found of various degrees of hardness; but none of them are capable of totally resisting the edge of a knife, or striking fire with steel. They are found to consist of a very friable earth, joined with a large quantity of air and some water. They effervesce with an acid when poured on them; by which they are distinguished from all other kinds of earth, except the argillaceous. When calcined by a strong fire, they part with the water and air which they contained, and then acquire a great degree of causticity, lose their power of effervescing with acids, and become what is called *quicklime*. They are soluble in acids, but not equally so in all. The vitriolic and tartareous acids form compounds with them very difficultly soluble; the *selenites*, formed by the vitriolic acid and calcareous earth, requiring, according to Mr Beaumé, an ounce of water to dissolve a single grain of it. The solubility of the tartareous selenite hath not yet been determined.—With the other mineral acids, the calcareous earths become easily soluble; and by proper management form concretes which appear luminous in the dark, and are called *phosphori*.

511 Quicklime.

512 Argillaceous.

2. The argillaceous earths differ from the calcareous, in not being convertible into quicklime. When mixed into a paste with water, and exposed to the fire, they shrink remarkably, crack in many places, and become excessively hard. By being gently dried in the open air before they are turned, they do not crack, and thus may be formed into vessels of any shape. Of this kind of earth are formed all the brown sort of earthen ware. The purest kind of argillaceous earth naturally found, is that whereof tobacco-pipes are made.

All the argillaceous earths are soluble in acids. With the vitriolic they dissolve into a gelatinous tough liquor very difficultly crystallizable; but which, on the addition of some fixed or volatile alkali, may be shot into crystals of the salt called *alum*. With the other acids they form astringent salts of a similar nature.

The attraction between the argillaceous earths and acids is very weak, yielding not only to alkaline salts both fixed and volatile, but even to some metals, particularly iron; but these earths have as yet been but little the subject of chemical examination in this way. They have a remarkable property of absorbing the colouring matter of cochineal, Brasil-wood, *&c.* as have also the calces of some metals.

Both the calcareous and argillaceous, and indeed all earths when pure, resist the utmost violence of fire; but when mixed together will readily melt, especially if in contact with the burning fuel. Dr Lewis having made covers to some crucibles of clay and chalk mixed together, found that they melted into a yellow glass, before the mixtures in the crucibles were fused in the least. But though they melted thus readily when in contact with the fuel, it was with great difficulty he could bring them to a transparent glass when put into a crucible.

Earths.

The other species of earths, *viz.* the flinty, fusible, and talky, being no other way the subjects of chemistry than as they are subservient to the making of glass, all that can be said of them will most properly come under that article. For their different species, see MINERALOGY.

513 Anomalous earths.

Besides the abovementioned species of earths, there are others which may be called *anomalous*, as having some resemblance of the calcareous and argillaceous, and yet being essentially different from them. These are the white earth called *magnesia alba*, the earth of burnt vegetables, and that produced from burning animal substances.

514 Magnesia.

Magnesia alba was at first prepared from the thick liquor remaining after the crystallization of nitre; and is now found to be contained in the liquor called *bittern*, which is left after the separation of common salt from sea-water. In the former case it was united with the nitrous, in the latter with the vitriolic, acid. It is also found naturally in the soft kind of stone called *steatites* or "soap-stone;" and in the concrete used for taking spots out of cloaths, called *French chalk*. It differs from the calcareous earths, in not acquiring any causticity when deprived of its air, of which it contains so large a quantity as to lose two-thirds of its weight when calcined. From the argillaceous it differs in not burning hard when mixed with water, nor forming a tough ductile paste. It is easily soluble in all the acids, even the vitriolic; with which it forms the bitter purging salt commonly called *Epsom salt*, from its being first discovered in the waters of Epsom. With all the other acids it likewise forms purgative compounds, which are either very difficultly or not at all crystallizable.—Like other pure earths, it cannot be melted by itself; but, on proper additions, runs into a beautiful green glass.

515 Vegetable and animal earths.

The earth of burnt vegetables is thought by Dr Lewis to be the same with magnesia alba; but on trying the common wood ashes, they were found to be very different. This kind of earth is fusible, by reason of the alkaline salts contained in it. Animal earth is both very difficult of solution in acids, and impossible to be melted in the strongest fire. It dissolves, however, in acid liquors, though slowly; but the nature of the compounds formed by such an union are as yet unknown. The softer parts of animals, such as blood, flesh, *&c.* are said to yield a more soluble earth than the others. Animal earth has lately been supposed to be compounded of calcareous earth and phosphoric acid; but this opinion is shown to be erroneous under the article BONES. The phosphoric acid produced from these, is with reason supposed to be only the vitriolic acid changed.

SECT. V. *Inflammable Substances.*

516 Phenomena on burning.

THESE comprehend all vegetable, animal, and some mineral substances. They are distinguished from all others, Inflammable Substances.

others, by emitting a grofs thick fmoke and flame, when a certain degree of heat is applied. To this, however, fpirit of wine and all preparations from it are exceptions. They burn without the leaft fmoke; and if a glafs bell is held over the burning fpirit, no foot is formed, only a quantity of water is found condenfed on its fides. Even the groffer oils, if flowly burnt with a very fmall flame, will yield no foot; and an exceeding great quantity of water, fully equal in weight and bulk to the oil employed, may be obtained from them. We can fcarcely, however, credit, that fo great a quantity of water comes from the oil; as this would be a real tranfmutation; and we know that, befides water, the oils contain alfo fome quantity of fixed air, as well as earth. It is probable, therefore, that, as it is impoffible to fuftain flame without a decompofition of that part of the air which rufhes in to fupport it, part of the water in this cafe comes from the air, which always contains moifture in abundance.

Inflammable matters, on being burnt, generally leave behind a fmall quantity of earthy matter called *afhes*; but to this, fpirit of wine, camphor, the more volatile oils, and the mineral oil called *naptha*, are exceptions.

517 On diftillation.

Vegetable fubftances, when diftilled in clofe veffels, give out a quantity of air, fome acid, and an empyreumatic oil, leaving behind a black fpongy mafs called *charcoal*. To this too there are a few exceptions, *viz.* fpirit of wine, and the preparations from it, camphor, and perhaps fome of the more volatile oils, or naphtha. Animal fubftances yield only a very fetid empyreumatic oil, and volatile alkali.

518 Treated with different acids.

In general, all inflammable matters are acted upon with fome violence by the vitriolic and nitrous acids, excepting only camphor and naphtha. With the vitriolic acid, when in a liquid ftate, they render it volatile and fulphureous; if in a dry ftate, they form actual fulphur. With the nitrous, they firft impart a high colour and great degree of volatility to the acid; then a violent flame enfues, if the matter is attempted to be dried. With fpirit of wine the effects are confiderably different; and very volatile compounds are formed, which are called *ether*, on account of their exceeding great difpofition to rife in vapour. Similar compounds are likewife produced, but with more difficulty, from the marine acid and concentrated vinegar. The fal fedativus of borax mixes with fpirit of wine, and caufes it burn with a green flame; but does not feem to produce any other change upon it. How the acid of phofphorus and of ants act upon fpirit of wine, is not exactly known; but that of tartar by digeftion with it, is converted into the acetous acid. With any other inflammable matter, the phofphorine acid reproduces phofphorus.

519 Singular productions.

There are two fingularities obferved among the inflammable fubftances. One is that bituminous matter called *amber*, which yields a volatile falt of an acid nature on diftillation: When combined with alkalies, this acid is found to yield compounds fimilar to thofe made with the acetous acid and alkali. The other is, that gum called *benzoin*, which is ufed as a perfume, and yields by fublimation a kind of volatile falt in fine fhining cryftals like fmall needles, and of a moft grateful odour. Thefe diffolve very readily in fpirit of wine; but not at all in water, unlefs it is made very hot: fo that they feem to contain more oily than faline matter. Neither the nature of thefe flowers, however, nor that of the falt of amber, is fully known.

Metalline Subftances.

## Sect. VI. *Metalline Subftances.*

These are diftinguifhed from all other bodies by their great fpecific gravity, exceeding that of the moft denfe and compact ftones. The heavieft of the latter do not exceed the fpecific gravity of water in a greater proportion than that of 4 to 1; but tin, the lighteft of all the metals, exceeds the fpecific gravity of water in the proportion of 7 to 1. They are alfo the moft opaque of all known bodies, and reflect the rays of light moft powerfully.

520 Metals foluble in acids.

Metallic bodies poffefs the quality of diffolving in and uniting with acid falts, in common with earths and alkalies; but, in general, their union is lefs perfect, and they are more eafily feparable. They effervefce with acids, as well as calcareous earths and alkalies; but their effervefcence is attended with very different appearances. In the effervefcence of acids with alkalies, or with calcareous earths, there is a difcharge of the fluid called *fixed air*, which is fo far from being inflammable, that it will immediately extinguifh a candle or other fmall flame immerfed in it. The mixture alfo is notably diminifhed in weight. When a metallic fubftance is diffolved in an acid, the weight of the mixture is never very much diminifhed, and fometimes it is increafed. Thus, an ounce of quickfilver being flowly dropped into as much aquafortis as was fufficient to diffolve it, and the folution managed fo as to take up almoft a whole day, the whole was found to have gained feven grains. There is alfo a remarkable difference between the nature of the vapour difcharged from metals and that from alkalies; the former, in moft cafes, taking fire and exploding with violence; the latter, as already obferved, extinguifhing flame.

521 Their compofition.

The metallic fubftances, at leaft fuch as we are able to decompound, are all compofed of a certain kind of earth, and the inflammable principle called *phlogifton*. The earthy part by itfelf, in whatever way it is procured goes by the name of *calx*. The other principle has already been proved to be the fame with charcoal. When thefe two principles are feparated from one another, the metal is then faid to be *calcined*.

522 Calcination and revivification

The calx being mixed with any inflammable fubftance, fuch as powdered charcoal, and urged with a ftrong fire melts into metal again; and it is then faid to be *reduced*, or revivificated: and this takes place whether the metal has been reduced to a calx by diffolution in an acid or by being expofed to a violent fire. If, however, the calcination by fire has been very violent and long continued, the calx will not then fo readily unite with the phlogifton of the charcoal, and the reduction will be performed with more difficulty. Whether, by this means, *viz.* a long continued and violent calcination, metallic earths might entirely lofe their property of combining with phlogifton, and be changed into thofe of another kind, deferves well to be inquired into.

523 Calcination and increafe of weight by acids.

When a metallic fubftance is diffolved in any kind of acid, and an alkali or calcareous earth not deprived of its fixed air is added, the alkali will immediately be attracted by the acid, at the fame time that the fixed

Metalline Substances.

ed air contained in the alkali is disengaged, and the calx of the metal, having now no acid to keep it dissolved, immediately joins with the fixed air of the alkali, and falls to the bottom. Something similar to this happens when metals are calcined by fire. In this case there is a continual decomposition of the air which enters the fire; and the fixed air contained in it, being, by this decomposition, set loose, combines with the calx; whence, in both cases, there is a considerable increase of weight. If the air is excluded from a metal, it cannot be calcined even by the most violent fire.

524 Reason of the increase of weights in metalline calces.

When a metal is precipitated by a mild alkali, or by an uncalcined calcareous earth, the reason of the increase of weight is very evident; namely, the adhesion of the fixed air to the metalline calx: but, though it is not so much increased when precipitated by caustic alkali, or by quicklime, there is nevertheless a very evident increase, which is not so easily accounted for. M. Lavoisier has mentioned some experiments made on mercury and iron dissolved in aquafortis, which deserve to be taken notice of, as in a great measure accounting for the phenomenon already mentioned of the solution of metalline substances gaining an addition of weight; and likewise show the proportion of increase of weight with the mild, or calcined calcareous earth.

525 M. Lavoisier's experiments.

"Exactly 12 ounces of quicksilver (says he) were put into a matrass, and 12 ounces of spirit of nitre poured on it. Immediately a spontaneous effervescence ensued, attended with heat. The red vapours of the nitrous acid arose from the mixture, and the liquor assumed a greenish colour. I did not wait till the solution was entirely accomplished before I weighed it; it had lost one drachm 18 grains. Three hours after, the mercury was nearly all dissolved: but having again weighed the solution, I was much astonished to perceive that it had increased instead of being diminished in weight; and that the loss, which was one drachm 18 grains at first, was now only 54 grains. The next day the solution of the mercury was entirely finished, and the loss of weight reduced to 18 grains; so that in 12 hours the solution, though confined in a narrow necked matrass, had acquired an augmentation in weight of one drachm. I added some distilled water to my solution, to prevent it from crystallizing; the total weight of it was then found to be 48 ounces 1 drachm and 18 grains.

"I weighed separately, in two vessels, 8 ounces 15 grains of the above solution, each of which portions, according to the preceding experiment, ought to contain 2 ounces of nitrous acid and 2 ounces of quicksilver. On the other side I prepared 6 drachms 36 grains of chalk, and 4 drachms 36 grains of lime; these proportions having been found by former experiments just necessary to saturate two ounces of nitrous acid. I put the chalk in the one vessel, and the lime in the other.

"An effervescence attended the precipitation by chalk, but without heat; the mercury precipitated in a light yellow powder, at the same time the chalk was dissolved in the nitrous acid. The precipitation by the lime was effected without effervescence, but with heat; the mercury was precipitated in a brownish powder. When the precipitates were well subsided, I decanted off the liquors from them, and carefully edulcorated them. After which, I caused them to be dried in a heat nearly equal to that in which mercury boils.

"The precipitate by the chalk weighed 2 ounces 2 drachms 45 grains; that by the lime weighed 2 ounces 1 drachm 45 grains.

"Sixteen ounces of the nitrous acid, the same as employed in the former experiments, were placed in a matrass, and some iron filings gradually added. The effervescence was brisk, attended with great heat, red vapours, and a very rapid discharge of elastic fluid: the quantity of iron necessary to attain the point of saturation was 2 ounces 4 drachms; after which, the loss of weight was found to be 4 drachms 19 grains. As the solution was turbid, I added as much distilled water as made the whole weight of the solution to be exactly 6 pounds.

"I took two portions, each weighing 12 ounces of the above solution, and containing 2 ounces of nitrous acid, and 2 drachms 36 grains of iron filings. I placed them in two separate vessels. To one were added 6 drachms 36 grains of chalk; and to the other 4 drachms 36 grains of slacked lime, being the quantities necessary to saturate the acid.

"The precipitation was effected by the chalk with effervescence and tumefaction, that by the lime without either effervescence or heat. Each precipitate was a yellow brown rust of iron. They were washed in several parcels of distilled water, and then dried in an heat somewhat superior to that used in the last experiment.

"The precipitate by the chalk, when dried, was a greyish rust of iron, inclining even to white by veins. It weighed 6 drachms 35 grains. That by the lime was rather yellower, and weighed 4 drachms 69 grains.

526 Consequences from his experiments;

"The result of these experiments (says M. Lavoisier) are, 1. That iron and mercury dissolved in the nitrous acid acquire a remarkable increase of weight, whether they be precipitated by chalk or by lime. 2. That this increase is greater in respect to iron than mercury. 3. That one reason for thinking that the elastic fluid contributes to this augmentation is, that it is constantly greater when an earth is employed saturated with elastic fluid, such as chalk, than when an earth is used which has been deprived of it, as lime. 4. That it is probable that the increase of weight which is experienced in the precipitation of lime, although not so great as that by chalk, proceeds in part from a portion of the elastic fluid which remains united to the lime, and which could not be separated by the calcination."

527 Not well founded.

But though we are naturally enough inclined to think that the increase of weight in the precipitates formed by lime proceeded from some quantity of elastic fluid or fixed air which remained combined with the lime, it is by far too great to be accounted for in this way, even according to the experiments mentioned by M. Lavoisier himself, and which, from the manner in which they are told, appear to have been performed with the greatest accuracy. He found, that 1 ounce 5 drachms and 36 grains of slaked lime contained 3 drachms and 3 quarters of a grain of water,

 and

Metalline Substances.

and only 16 grains and an half of elastic fluid were separable from it. In the experiments above related, where only 4 drachms and 36 grains were employed, the quantity of elastic fluid could not exceed 6 or 8 grains. Yet the calx was increased in mercury by no less than 105 grains, and in iron by 203 grains; a quantity quite unaccountable from the elastic fluid or fixed air which we can suppose to be contained in the lime made use of. It is much more probable, that the increased weight of metallic precipitates, formed by lime, arises from an adhesion of part of the acid.

Metals are found to be compounded of a kind of earth mixed with the inflammable principle or phlogiston; and by a dissipation of the latter, all metallic bodies, gold, silver, and platina excepted, are capable

530 What metals are calcinable, & with what degrees of heat.

of being reduced to a calx, but very different degrees of heat are required for calcining them. Lead and tin begin to calcine as soon as they are melted, long before they are made red-hot. The same happens to the semimetals bismuth and zinc; the latter indeed being combustible, cannot bear a greater heat in open vessels than that which is barely sufficient to melt it. Iron and copper require a red heat to calcine them; though the former may be made partly to calcine by being frequently wetted in a degree of heat considerably below that which is sufficient to make it red.

541 Rusting of metals

Most metals undergo a kind of spontaneous calcination in the open air, which is called their *rusting*; and which has given occasion to various conjectures. But M. Lavoisier has shown, that this arises from the fixable part of the atmosphere attaching itself to their earthy part, and discharging the phlogiston. According to him, no metallic body can rust but where there is an absorption of air; and consequently metals can be but imperfectly rusted when kept under a receiver.

542 Fusibility of metallic compounds.

If two metals are mixed together, the compound generally turns out more fusible than either of them was before the mixture. There are indeed great differences in the degrees of heat requisite to melt them. Thus, lead and tin melt below that degree of heat which is required to make quicksilver or linseed-oil boil. Silver requires a full red heat, gold a low white heat, copper a full white, and iron an extreme white heat, to make it melt. The semimetal

543 Great fusibility of compounds of tin and bismuth.

called bismuth melts at about 460° of Fahrenheit's thermometer, and tin at about 422°. When mixed in equal quantities, the compound melted at 283°. When the tin was double the bismuth, it required 334° to melt it; with eight times more tin than bismuth, it did not melt under 392°. If to this compound lead is added, which by itself melts in about 540°, the fusibility is surprisingly increased. Mr Homberg proposed for an anatomical injection a compound of lead, tin, and bismuth, in equal parts; which he tells us keeps in fusion with a heat so moderate that it will

544 One fusible by the heat of boiling water.

not singe paper. Sir Isaac Newton contrived a mixture of the abovementioned metallic substances, in such proportions that it melted and kept fluid in a heat still smaller, not much exceeding that of boiling water. A compound of two parts of lead, three parts of tin, and five of bismuth, did but just stiffen at that very heat, and so would have melted with very little more; and when the lead, tin, and bismuth, were to one another in the proportions of 1, 4, and 5, the compound melted in 246°. We have seen, however, a piece of metal compounded of these three, the proportions unknown, which melted, and even underwent a slight degree of calcination, in boiling water, and barely stiffened in a degree of heat so gentle that the hand could almost bear it.

545 Solubility of metals increased by calcination.

A slight degree of calcination seems to give the acids a greater power over metallic substances; a greater makes them less soluble; and if long and violently calcined, they are not acted upon by acids at all. Of all the acids, the marine has the greatest attraction for metallic calces, and volitalizes almost every one of them.

346 Effects of sulphur on metals.

Sulphur readily unites with most metals, destroys their malleability, and even entirely dissolves them. On gold and platina, however, it has no effect, till united with a fixed alkaline salt, when it forms the compound called *hepar sulphuris*; which is a very powerful solvent, and will make even gold and platina themselves soluble in water, so as to pass the filter. This preparation is thought to be the means by which Moses dissolved and gave the Israelites to drink the golden calf which they had idolatrously set up.

When a metal is dissolved in an acid, it may be precipitated, not only by means of calcareous earth and alkalies, but also by some other metals; for acids do not attract all metals with equal strength; and it is remarkable, that when a metal is precipitated by another, the precipitate is not found in a calcined state, but in a metallic one. The reason of this is, that the precipitating metal attracts the phlogiston which is expelled from that which is dissolving, and immediately unites with it, so as to appear in its proper form. The various degrees of attraction which acids have for the different metals, is not as yet fully determined. The best authenticated are mentioned in the Table of Affinities or elective attractions (Sect. IX.)

547 Division into metals and semimetals.

Metalline substances are divided into metals and semimetals. The metals which are distinguished from the semimetallic substances by their malleability or stretching under the hammer, are in number seven; gold, silver, copper, iron, lead, tin, and platina. To these is added quicksilver; which Mr Brown's experiments have shown to be a real malleable metal, as well as others, but requiring so little heat to keep it in fusion, that it is always found in a liquid state. The semimetals are bismuth or tin-glass, zinc, regulus of antimony, and cobalt, nickel, and arsenic. This last 548

548 Properties of arsenic.

substance is now discovered to be compounded of an acid of a peculiar kind and phlogiston; and as the quantity of the latter is great or small, the arsenic assumes either a metallic or saline form. It likewise unites with sulphur, with which it forms a compound of a red or yellow colour, according as more or less sulphur is used. This compound is easily fusible; though the arsenic, by itself, is so volatile as to go all off in vapour rather than melt. In common with the salts, it possesses the properties of dissolving in water, and uniting itself to alkalies. Water will dissolve about $\frac{1}{11}$ of its weight of pure arsenic; but if arsenic is boiled in a strong alkaline lixivium, a much greater proportion will be dissolved. Indeed strong alkaline lixivia will dis-

solve

# CHEMISTRY

## *Chemical Characters or Symbols*

Waters,&c. solve a part of almost every metalline substance, except gold, silver, and platina; but, excepting copper, which may be formed into crystals by means of the volatile alkali, none of them will assume a crystalline form when united with alkalies. Arsenic, on the contrary, unites very readily with fixed alkalies, and shoots with them into a neutral salt. If it is mixed with nitre, it unites itself to the alkaline basis of that salt, and expels the acid in very volatile fumes, which are difficultly condensed into a blue liquor. The reason of this is the great attraction between the nitrous acid and phlogiston, which are always disposed to unite when a proper degree of heat is applied. Was the phlogiston contained in large quantity in the arsenic, and the heat sufficiently great, a violent deflagration would ensue; but as the acid of arsenic attracts the alkaline part of the nitre, at the same time that the nitrous acid attracts the phlogiston, a double decomposition ensues, in a less degree of heat than would otherwise be necessary; and the nitrous acid arises in a very volatile state, as it always is when combined with phlogiston, which is the occasion of the blueness in aquafortis so produced. The arsenic is also decomposed by being deprived of its proper quantity of phlogiston; in consequence of which its acid attaches itself to the fixed alkali of the nitre, and forms a neutral arsenical salt. For the extraction of metallic substances from their ores, and the various methods of refining them, see METALLURGY.

## SECT. VII. *Waters.*

THE pure element of water, like that of fire, is so much an *agent* in most chemical operations, as to be itself very little the *object* of practical chemistry. Some late experiments, however, have shown that this fluid really consists, in part at least, of phlogiston, and an invisible substance which forms the basis of pure air: and consequently water is generated in the deflagration of dephlogisticated air; but as the basis of the former cannot be perceived by itself, we can as yet say nothing

549 Water, how far an object of chemistry.

about it. Waters, therefore, can only be the objects of chemistry, in consequence of the impurities they contain: and as these impurities are most commonly of the saline kind, it is impossible that any general theory can be given of waters, distinct from that of the salts contained in them; which all depend on the general properties belonging to salts, and which we have already mentioned. Any thing that can be said with regard to waters, then, must be postponed to the particular consideration of the properties of each of the saline bodies with which water is capable of being adulterated. We shall therefore refer entirely to the article WATER in the order of the alphabet, for what can be said on this subject.

## SECT. VIII. *Animal and Vegetable Substances.*

550 Chemical properties.

THE general chemical properties of these have been already taken notice of under the name of *inflammable substances*. They agree in giving out a very thick fetid oil, when distilled by a strong fire; but in other respects they differ very considerably. Most kinds of vegetables give out an acid along with the oil; but all animal substances (ants, and perhaps some other insects, excepted) yield only a volatile alkali. Some kinds of vegetables, indeed, as mustard, afford a volatile alkali on distillation, similar to that from animal substances; but instances of this kind are very rare, as well as of animals affording an acid. Both animal and vegetable substances are susceptible of a kind of fermentation, called *putrefaction*, by which a volatile alkali is produced in great plenty: there is, however, this remarkable difference between them, that many vegetable substances undergo two kinds of fermentation before they arrive at the putrefactive stage. The first is called the *vinous*, when the ardent spirits are produced, which we have already mentioned when speaking of inflammable substances. This is succeeded by the *acetous*, wherein the vegetable acid called *vinegar* is produced in plenty: and lastly, the putrefactive stage succeeds when a volatile alkali is only produced; not the smallest vestige either of ardent spirits or of vinegar remaining. On the other hand, animal substances seem susceptible only of the putrefactive fermentation; no instance having ever occurred where there was the least drop, either of ardent spirit or of vinegar, produced from a putrified animal substance. (See FERMENTATION and PUTREFACTION.)

Chemical Characters

## SECT. IX. *Of the Chemical Characters, and Tables of Elective Attraction.*

THE numerous *marks* or *characters* by which the ancient chemists used to denote many different substances were invented rather from a superstitious and fantastical principle than from any real necessity; or, perhaps, like the enigmatical language used by the alchemists, they have thereby sought to conceal their mysteries from the vulgar. In contriving these marks, they affected a great deal of ingenuity; intending them as symbols of the qualities possessed by each of the different substances. A circle being supposed the most perfect figure, was therefore used to represent the most perfect metal in nature, that is, *gold*. Silver being likewise a perfect and indestructible metal, is placed next to gold; but, on account of its inferiority, is expressed only by a crescent, as if but half gold. A circle was likewise used to denote salt of any kind, as being something elaborate and perfect. A cross was used to denote acrimony of any kind, and consequently employed for the acrimonious salts of vitriol, alkali, &c. Hence all the inferior metals have the cross some how or other combined with the marks designed to represent them. Thus, the mark for quicksilver denotes, that it hath the splendor of silver, the weight of gold, but its perfection is hindered by an acrimony represented by the cross at bottom, &c. Fire is represented by an equilateral triangle, having one of its angles uppermost. This may be considered as a rude representation of flame, which is always pointed at top. Water, again, is represented by a triangle, with an angle downwards, showing the way in which that element exerts its strength, &c. All these marks, however, as they were of no real use at first, so they are now becoming every day more and more neglected. Such of them, however, as may most readily occur in chemical books, are represented and explained on Plate CXXXII.

551 Invention of marks or characters.

The French chemists have of late attempted to introduce a kind of new chemical language; and by adopting it themselves, may perhaps make it at last universal,

552 New chemical language.

Elective Attraction.

verſal, as it is now impoſſible to underſtand their writings without knowing it. See the Table at the end of this article.

553 Of tables of affinities.

*Tables of affinities*, or *elective attractions*, are but of late invention. They are conſequences of an improved ſtate of chemiſtry, when the different ſubſtances were found to act upon one another in moſt caſes according to a fixed and ſettled rule. The moſt approved table of this kind for a long time was that compoſed by Mr Geoffroy. It was, however, found to be very incomplete, not only as to its extent, but likewiſe as heat and ſome other circumſtances were found to vary the attractions conſiderably, and ſometimes even to reverſe them. Other tables have been conſtructed by Mr Gellert, &c. but none hath yet appeared ſo complete but that many additions may be made to it. The following is that at preſent exhibited by Dr Black in his courſe of chemiſtry.

1. VITRIOLIC ACID.
Phlogiſton
Terra ponderoſa
Fixed alkali
Calcareous earth
Zinc
Iron
Tin
Copper
Quickſilver
Silver
Volatile alkali
Magneſia
Earth of alum.

2. NITROUS ACID.
Phlogiſton
Fixed alkali
Calcareous earth
Zinc
Iron
Lead
Tin
Copper
Quickſilver
Silver
Volatile alkali.

3. MARINE ACID.
Fixed alkali
Calcareous earth
Zinc
Iron
Lead
Tin
Copper
Regulus of antimony
Quickſilver
Silver
Spirit of wine
Volatile oils
Gold.

4. SULPHUR.
Fixed alkali
Calcareous earth
Iron
Nickel
Copper
Lead
Tin
Silver
Regulus of antimony
Quickſilver
Arſenic.

5. HEPAR SULPHURIS is partially decompounded by
Quickſilver
Solution of fixed alkali
Lime-water
Volatile alkali.

6. FIXED AIR.
Calcareous earth
Fixed alkali
Magneſia
Volatile alkali.

7. ALKALINE SALTS.
Vitriolic acid
Nitrous acid
Marine acid
Acetous acid
Volatile vitriolic acid
Sedative ſalt
Fixed air
Sulphur
Expreſſed oils.

8. CALCAREOUS EARTH.
Vitriolic acid
Nitrous acid
Marine acid
Acid of tartar
Acetous acid
Sulphureous acid and ſedative ſalt
Sulphur.

9. METALLIC SUBTSANCES, Lead and Regulus of Antimony excepted.
Marine acid.
Vitriolic acid
Nirtous acid
Sulphur and acetous acid.

10. LEAD.
Vitriolic acid
Marine acid
Nitrous acid
Acetous acid
Expreſſed oils.

11. REGULUS of ANTIMONY.
Vitriolic acid
Nitrous acid
Marine acid
Acetous acid.

12. ARSENIC.
Zinc
Iron
Copper
Tin
Lead
Silver
Gold.

13. REGULUS of ANTIMONY with Metals.
Iron
Copper
Tin
Lead
Silver
Gold.

14. QUICKSILVER.
Gold
Lead and tin
Copper
Zinc, biſmuth, and regulus of antimony.

15. SILVER.
Lead
Copper
Iron.

16. WATER.
Fixed alkali
Spirit of wine
Milk, alkaline ſalts, and ſome neutrals.

17. SPIRIT of WINE.
Water
Oils and reſins.

In conſequence of heat, ſedative ſalt and the other ſolid acids decompound vitriolated tartar, nitre, and ſea-ſalt.

Double Elective Attractions; which, in ſome caſes, may be conſidered as exceptions to the foregoing table.

I. Thoſe which happen in mixtures of watery ſubſtances.

| | | |
|---|---|---|
| 1. | Acids | Volatile alkali |
| | Calc. earths, or metallic ſubſtances | Fixed air. |
| 2 | Vitriolic or marine acids | Mercury, ſilver, or lead, |
| | Alkalies or earths | Nitrous or acetous acids. |
| 3 | Lead | Vitriol acid |
| | Nitrous marine, or acetous acids | Alkalies, earths, or M. S. |
| 4. | Silver | Marine acid |
| | Vitriolic, nitrous, or acetous acids | Alkaline ſalts, earths, or M. S. |
| 5. | Volatile alkali | Fixed air |
| | Acids | Fixed alkali. |
| 6. | Nitrous, marine, or acetous acids | Volatile alkali, magneſia, or earth of alum |
| | Calcareous earths | Vitriolic acid. |

II. Thoſe which happen in diſtillations or ſublimations, and require heat.

| | | |
|---|---|---|
| 1. | Vol. alkali | Fixed air |
| | Acids | Calcareous earths. |
| 2. | Vol. alkali | Nitrous, marine, or acetous acids |
| | Vitriol. acid | Fixed alkali. |
| 3. | Vol. alkali | Acetous acid |
| | Nitrous, marine, or vitriolic acids | Fixed alkali, or abſorbent earths. |

4.

Chemical Operations.

| | | |
|---|---|---|
| 4. | Reg. of antimon. / Sulphur | Marine acid / Quickfilver. |

III. Thofe which happen in mixtures by fufion.

| | | |
|---|---|---|
| 1. | Tin / Silver | Iron / Lead. |
| 2. | Copper / Gold | Sulphur / Lead. |
| 3. | M. S. / Gold | Sulphur / Reg. of ant. |

The firft of thefe tables requires very little explanation. The names printed in fmall capitals, are thofe of the fubftances which have the affinity with or attract thofe below them. Thus, vitriolic acid attracts moft powerfully the phlogifton, or inflammable principle: next, fixed alkali; then, calcareous earth; and fo on, in the order in which they are marked. — The tables of double elective attractions cannot be made quite fo diftinct; though an explanation of one example will make this likewife eafy to be underftood. Thus in Table I. the firft cafe is, "If a combination of acids with calcareous earths or metallic fubftances is mixed with a combination of volatile alkali and fixed air, the acids will unite themfelves to the volatile alkali, and the fixed air to the calcareous earth or metallic fubftance.

Sect. X. *Of the different Operations in Practical Chemiftry, and the proper Inftruments for performing each.*

554 Operations in chemiftry.

The moft remarkable operations in chemiftry, and by which the greateft changes are made upon thofe bodies which are the objects of that fcience, may be comprehended under the following names. 1. Solution. 2. Filtration. 3. Precipitation, or coagulation. 4. Evaporation. 5. Cryftallization. 6. Diftillation. 7. Sublimation. 8. Deflagration. 9. Calcination. 10. Fufion. 11 Maceration, or digeftion. To which we may add, 12. Trituration, or levigation.

555 Chemifts how divided.

Before we proceed to a particular account of each of thefe operations, it is neceffary to take notice, that there are two different things propofed by thofe who enter on the practice of chemiftry. Some have nothing farther in view than the enlargement of their knowledge, or making improvements in arts which are to be practifed by others for their own advantage. Others defign to follow chemiftry as a trade, by which they hope to enrich themfelves, or to get a comfortable livelihood. But the apparatus and utenfils neceffary for performing the very fame operations are exceedingly different when experiments only are to be made, from what they muft be when thefe operations are performed with a view to profit; and fo great is this difference, than thofe who purfue chemiftry with a view to advantage, will always find themfelves very confiderable lofers if they follow the plan of an apparatus or a laboratory defigned only for making experiments. Along with the apparatus, therefore, which is commonly defcribed in chemical books, and proper only for experiments, we fhall alfo give that which is neceffary for preparing great quantities of any chemical article in the way of trade.

556 Glafs veffels, when to be ufed.

In general, thofe who practice chemiftry merely with an experimental view, ought, as much as poffible, to make ufe of glafs veffels, as not being liable to be corroded by the moft powerful folvents; and, by their tranfparency, giving an opportunity of obferving what paffes within them during the operation. But by thofe who practife chemiftry with a different view, thefe veffels ought, with equal care, to be avoided, on account of their expence and brittlenefs. This laft quality, indeed, is poffeffed by glafs in fo eminent a degree, that glafs veffels will fometimes fly to pieces, and that with confiderable violence, when ftanding by themfelves, and nothing touching them. The principle objects which a chemift ought to have in view, in performing his operations, ought to be to fave time and fuel, efpecially the former; and for this purpofe, he would find himfelf a confiderable gainer, though he fhould be at much greater expence in his apparatus than he would otherewife have occafion for.

557 Dr Black's obfervations on chemical veffels.

On the fubject of chemical veffels Dr Black obferves, that "with regard to the material of which thefe are compofed, we are very much at a lofs; and indeed there are no fuch materials in nature as are capable of anfwering the purpofes of chemifts in abfolute perfection.—The qualities are, 1. Tranfparency to allow us to fee the changes going on; 2. The power of refifting the action of acids and corrofive fubftances; 3. That they bear fudden alterations of heat and cold without breaking; 4. That they be ftrong, in order to confine elaftic vapours; and, 5. That they bear very great heat without melting. As thefe qualities, however, are not to be met with united in any one fubftance, the chemifts are obliged to have recourfe to different fubftances which poffefs fome of them differently. Thefe are, *glafs*, *metal*, and *earthen ware*.

558 Good and bad qualities of glafs as a material for chemical veffels.

Glafs is poffeffed of the two firft properties, but has the inconvenience of being apt to crack and fly in pieces, on any fudden tranfition from heat to cold, or from cold to heat. The beft method of remedying this defect, is to have the glafs made very thin, and of a round figure, that it may be all heated as equally as poffible; as it is the unequal application of the heat which caufes it break. Another requifite in the choice of chemical glaffes, is that they be well annealed. If this is not done, the glafs will either immediately fly to pieces, or be liable to break on the fmalleft accident.

559 Extreme fragility of glafs not well annealed.

That fuch glaffes fhould be liable to be broken on every flight occafion, is a phenomenon that has hitherto received no explanation. If you touch them with a diamond, with a piece of flint, glafs, *&c.* or expofe them to the heat of the fun, they break immediately. Dr Black has had great veffels of glafs, which broke immediately on his throwing a little fand into them to clean them. This manifeftly depends upon the fame principles as the qualities of what are called *glafs tears*.

560 Good and bad qualities of metals as materials for chemical veffels.

Glafs when well annealed is univerfally to be preferred, where great and fudden changes of heat, or much ftrength, are not required. Flint-glafs is the beft; but the coarfer kinds, as bottle-glafs, are very apt to break.

The metals have the third and fourth qualities in perfection, but are deficient in all the reft. The moft troublefome property is, that they are liable to be corroded by acids and other bodies, as is the cafe with iron and copper; though this is in fome meafure

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measure remedied by tinning; which, though it wants some of the qualities from its melting too soon, yet resists the action of many acrid substances without being so readily injured by them; but it is not entirely free from this imperfection, and is liable to be somewhat corroded and rusted. In nice operations, therefore, recourse is had to silver and even to gold vessels.

561 Of earthen ware.

Earthen ware possesses only the fifth quality in perfection, *viz.* that of bearing a violent heat without fusion. The basis of these vessels is clay, which, when good, is very convenient for the formation of vessels, and it has been used from the earliest ages of chemistry for this purpose. The requisite qualities are, 1. A considerable degree of toughness when mixed with water. 2. A great degree of hardness when burnt in the fire with a violent degree of heat. The best kind of clay thus contracts a degree of hardness scarce inferior to flint, as is the case with that of which tobacco-pipes are made; but most other kinds, such as that of which bricks are constructed, are apt to melt with a strong heat into a spongy matter. Clay, however, can seldom be used alone; for when burnt to extreme hardness, the vessels are very liable to crack. This is remedied by mixing sand reduced to a particular degree of fineness, with the clay of which the vessels are made. For this purpose both the finest and the coarsest particles of the sand must be thrown away.

562 Black lead a valuable material for some purposes.

Another substance known by the name of black lead, used in the making of pencils, resists the fire exceedingly. This, however, does not contain an ore of lead, but sulphur, and some mineral substances; when mixed with clay, however, it makes it resist the fire surprisingly. But there are some particular cases in which neither sand nor black lead can be used as a material; for the sand is easily corroded by acrid matters, and the black lead would produce other inconveniences. Clay is therefore to be taken in its unburnt state, reducing it to a powder like sand; then burning this powder with a violent heat, so as to convert it into sand. Mixing it then with raw clay, it forms a composition which answers very well for making chemical vessels, and may be employed in those particular cases where sand would not answer. Pott of Berlin has written upon the different kinds of earthen ware proper to be employed in the construction of chemical vessels. There is a French translation of it in four or five volumes.

563 Porcelain vessels when to be used.

In cases where the utmost compactness of texture is required, procelain vessels are to be chosen; which is composed of the finest clay, mixed with a stony matter, that has the quality of melting in a violent heat, and gives more compactness to the clay than it is naturally capable of receiving; but these are rather too costly for most operations. Reaumur has taught a way of converting glass into porcelain.

We shall now proceed to a particular description of each of the operations abovementioned.

564 Solution.

I. Solution. By this is understood the dissolving a solid substance in a fluid, so as that the solid shall totally disappear, and become part of a transparent liquor. This operation applies particularly to salts, earths, and metals: as well as to several unctuous and inflammable substances. For performing this operation in a small way, common vials are in many cases sufficient. Where the solution is attended with effervesence and a discharge of vapours, the long-necked glasses called *matrasses*, or *bolt-heads*, (fig. 5.), are necessary. Florence flasks are indeed exceedingly well adapted for this operation, as being of the proper shape, and capable of bearing heat so well, that they may be filled with any fluid, and set on a common fire like a metalline vessel. Solution is much promoted by agitating the vessel, and by heat. In some cases, indeed, it will not take place till the mixture becomes very hot; and in such cases it will be proper to make the fluid boiling hot by itself, and then slowly to add the substance to be dissolved.

Plate CXXXIV.

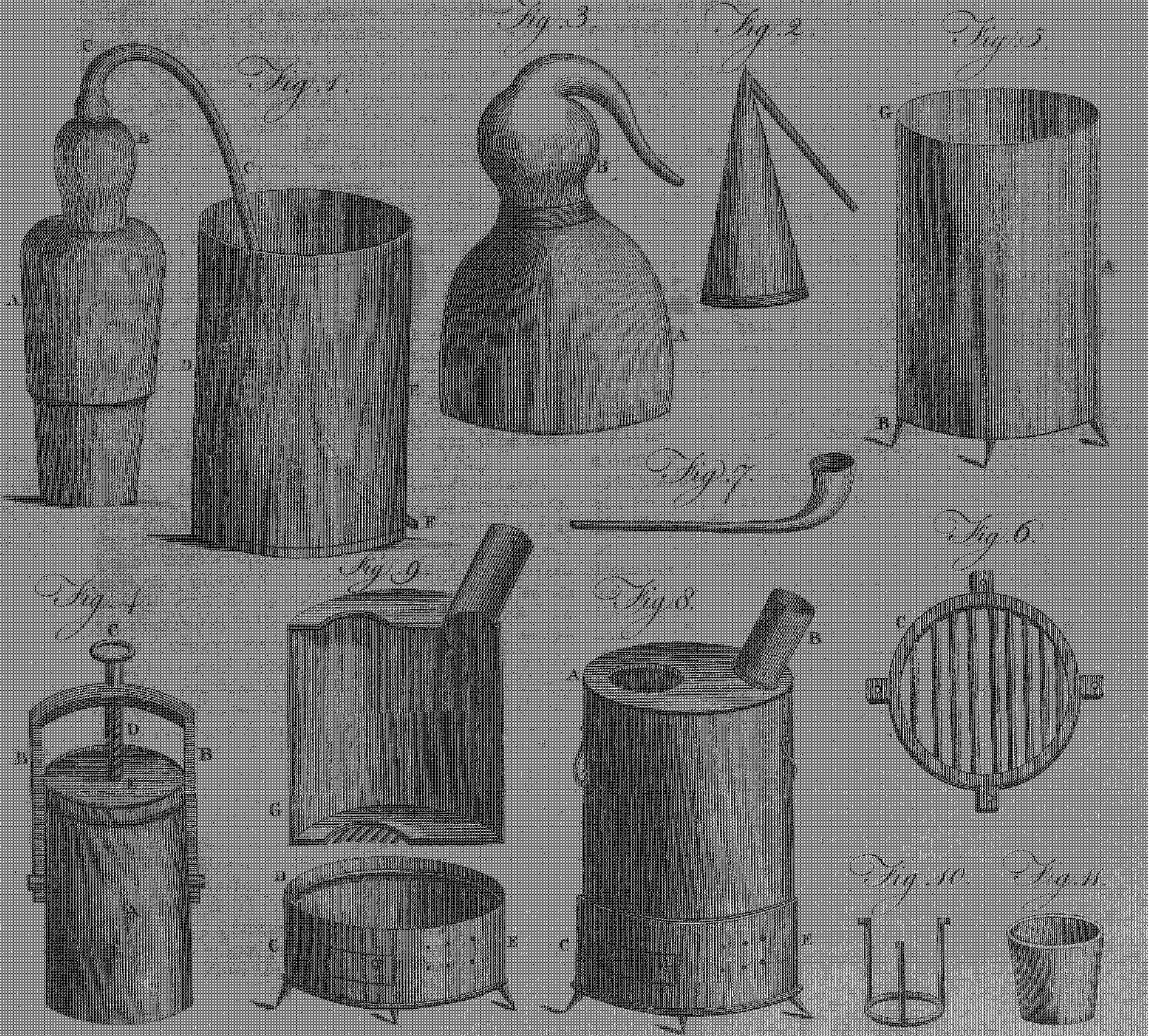
When large quantities of saline matter are to be dissolved, metalline vessels must be used: but before any are made use of for this purpose, it will be necessary to make an experiment whether the salt receives any impregnation from the metal of which the vessel intended to be made use of is formed; and if this is found to be the case, it must not be used. The metals most liable to be corroded by saline bodies are iron and copper; and indeed, unless it be for the single purpose of dissolving fixed alkaline salts, iron vessels seem totally unfit for saline solutions of any kind. Copper vessels are also very liable to be corroded, and to communicate very mischevous qualities to the liquors which corrode them; for which reason, they ought never to be made use of for the purposes of solution. The metal least liable to be corroded, next to gold and silver, is lead; and therefore a chemist ought rather to provide himself with leaden vessels than those of any other metal. But though lead is not apt to be corroded by many kinds of salts, there are some which are found to act upon it, and to form therewith a very dangerous poison. The vegetable acid of vinegar is particularly apt to receive a dangerous impregnation from this metal; and therefore no solution of any salt containing this acid ought to be made in leaden vessels. It appears to be very little affected by the vitriolic or marine acids; and therefore any saline substance containing either of these acids may be safely enough dissolved in vessels made of lead.

In order to save time in making solutions, the vessels ought to be as large as possible; though even in this there must be a certain limit: for two small vessels filled with water will sooner acquire the necessary degree of heat than one large one; and in proportion as the vessel is made more capacious, the sides and bottom must be thicker, which considerably increases the expence. Fifteen or twenty English gallons is the utmost capacity of which they ever will be required; and is rather above what will on most occasions be necessary. They ought to be of a conical figure, round at the bottom; and to have a cover of thick plate-iron all around that part which is exposed to the action of the fire, that the lead may not bend on the application of heat, which it would otherwise be very apt to do. When the solution is to be made, the leaden vessel is first to be filled up with water so far as to have room for the quantity of salt intended to be dissolved: a fire is then to be applied so as to make it boil: and then the salt is to be added slowly, so as scarcely to hinder the boiling; for if a great quantity was thrown in at once, so as to cool the liquor very much, great part of the salt would concrete on the bottom, in such

# CHEMISTRY. Plate CXXXIII.

*Chemical Characters or Symbols.*

| | | | |
|---|---|---|---|
| *Acid of Fluor* | *Amber* | *Colouring matter of* | *Fixed vegetable* |
| *Arsenic* | *Sugar of Milk* | *Prussian Blue, falsely* | *Alkali* |
| *Borax* | *Vinegar* | *called an Acid.* | *Mineral Alkali* |
| *Sugar* | *Milk* | *Phlogisticated vitri-* | *Ponderous Earth* |
| *Tartar* | *Ants* | *olic Acid the same w.t* | *Pure Air* |
| *Sorrel* | *Fat* | *Vol. Sulphureous Acid.* | *Platina* |
| *Lemon* | *Phosphorus* | *Dephlogisticated* | *Manganese* |
| *Benzoin* | *Aerial* | *Marine Acid.* | *Metallic calx* |




Thackara & Vallance Sculp.t

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a manner as not only to be very difficultly soluble, but even endanger the melting of the vessel. It is of some consequence also to avoid the hot steam which proceeds from the boiling water, and which issues with great force from a narrow-mouthed vessel, such as we have been describing. That the operator may be out of the reach of this, and likewise dissolve the salt in a regular and gradual manner, without any danger of its concreting on the bottom, it will be proper to have a leaden, or even a wooden, vessel, with a long handle; which is to be filled with the substance to be dissolved, then immersed in the boiling liquor, and shaken about in it, till the salt is made into a kind of thick pap, which will be in no danger of concreting. It will also be proper not to saturate the water perfectly with salt; for it will in that case be impossible to hinder part of it from settling on the bottom, where it soon acquires such a degree of heat as to melt the lead. Before any saline substance is put into water for solution, it ought to be pounded and sifted through a hair sieve.

Where large quantities of metal are to be dissolved in acids, especially the nitrous acid, glass vessels are in a manner indispensable; although the common stone-ware bottles, especially those made in Holland, will answer the purpose very well, as not being liable to corrosion, and not so apt to break as the glass vessels are. They may be got of such a size as to hold three or four gallons: but no vessel in which metalline solutions are made ought ever to be above half full.

In solutions of oily and inflammable substances, cast iron vessels are perhaps the most proper of any; though copper ones are generally preferred. The copper is excessively soluble in oil, especially if it is left to cool in such a vessel; but iron is not soluble in any inflammable matter except sulphur. Copper has, however, this advantage over iron, that it is sooner cooled, as the vessels made of copper are thinner than they can be made of cast iron: so that if too great heat is applied to a copper vessel, it may be easily remedied by taking it off the fire; but in a cast iron vessel the heat continues so long as may sometimes produce dangerous consequences, even after the fire is removed.

565 Dr Black's directions for solution.

Dr Black observes, that for the purpose of solution, if no particular nor uncommon consequence follow the application of the two bodies to each other, and if none of them be very volatile, any glass or porcelain vessel that can resist the action of the substances will answer the purpose; but it often happens that they break out into violent ebullition, which produces steam; and here a common vessel is not so proper, as we would wish to have the vapour confined or condensed. We therefore choose a close vessel that will bear the heat suddenly produced by the mixture, or the heat that may be necessary to promote the action of such bodies upon one another. Of this kind is the *phiala chemica*, or matrass, in which the vapours will have time to circulate and to be condensed again, without being allowed to escape. Where the matter is in small quantity, smaller vessels somewhat of the same form are used, as Florentine flasks, which bear sudden changes of heat and cold remarkably well, on account of their thinness. In order to promote the action of bodies, it is sometimes necessary to make the fluids boil; and for this purpose we must have a matrass with a large neck, or apply another vessel to it that will receive these steams, and give them still more room for their condensation, and direct them to fall back again, when condensed, into the matrass. This is called *circulation*. Macquer describes another vessel called the *pelican*, which has been made use of for this purpose; but it is hardly ever employed, on account of its being so troublesome to procure and manage it; and the advantages arising from it may be obtained by a more simple apparatus.

566 Pelican. Fig. 6.

567 Papin's digester. Plate CXXXIII.

To this head we must refer Papin's digester, which is represented Fig. 4. It is generally made of copper, very thick and strong, open at the top, with a lid fitted to it, which applies very exactly. There are usually two projections on the side, designed to make the lid go in a particular manner, but they are unnecessary. There are other two, to which are fitted the two sides of a cross bar B B; in which cross bar there is a strong screw D, by which the lid can be pressed down very strongly. Its use is to force water to bear a stronger heat than it can do under the ordinary pressure of the atmosphere. It is sometimes furnished with an apparatus for letting out the steam, lest it should be in danger of bursting the vessel. A pipe is passed through the lid which is fitted with a valve, on which passes a lever at a very small distance from its centre of motion; and this can be made to press on the valve with different weights, according to the distance of these weights from the centre. In one constructed by Dr Black, there was another pipe below, into which a thermometer could be introduced, in order to measure the degree of heat to which the steam was raised. This machine was pretty much employed some time ago, and its effects were much admired; but we find that most things which can be dissolved in this way, can likewise be dissolved in the ordinary way by boiling water, provided it is continued for a longer time, as animal bones, from which the gelatinous parts are indeed extracted very quickly by this vessel; but the same change is produced by boiling them in water for a long time in the ordinary degree of heat.

568 Filtration.

II. Filtration. This operation is generally the attendant of solution: very few substances, of the saline kind especially, are capable of being dissolved without leaving some impurities, from which they must be freed; and the doing of this, so as to render the solution perfectly transparent, is what is understood by the word *filtration*.

For purposes merely experimental, a glass funnel and piece of paper are generally sufficient. The paper is formed into a conical cap, which being placed in the funnel with its point downwards, the funnel is then placed in the mouth of a vial; and the solution or other liquor to be filtered is poured into the paper cap, through which the liquor passes transparent, leaving its impurities on the paper. For the purpose of filtration, paper has come into such general use, that a particular kind of it is prepared under the name of *filtering paper*. This is of a reddish colour; but Dr Lewis prefers the whitish grey paper which comes from Holland about the pill boxes, as not giving any colour to the solutions which pass through it.

This operation though apparently so simple and easy, is nevertheless attended with very troublesome circumstances, on account of the great time it takes up. Even where very small quantities of liquor are to be filtered, merely

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merely for experiment's ſake, the impurities frequently ſettle on the paper ſo ſoon, and obſtruct its pores to ſuch a degree, that the operator is often quite wearied out: often, too, the paper breaks; and thus the whole is ſpoiled, and the operation muſt be begun over again.

To avoid theſe inconveniences, another method of filtration has been propoſed; namely, to uſe a number of cotton threads, the ends of which are to be immerſed in the liquor, and the other ends are to hang over the ſide of the veſſel which contains it, and to hang lower than the ſurface of the liquor. By this means they will act as ſo many capillary ſyphons, (ſee SYPHON); the liquor will ariſe in them quite pure, and be diſcharged from their lower extremities into a veſſel placed to receive it. That the liquor may flow freely into the cotton, it will be proper to wet the threads before they are uſed.

In point of efficacy, no doubt, this method excels every other; and where the operator has abundance of time and patience, may be proper for experiments; but, in the way of trade, ſuch a contrivance is evidently uſeleſs. For filtering large quantities of liquor, therefore, recourſe has been had to large funnels; earthen cullenders, or baſons full of holes in the bottom, lined with filtering paper; and to conical bags of flannel or canvas

The inconveniences attending funnels, when uſed only in the way of experiment, are much greater when they are employed for filtering large quantities of liquor; and therefore they are generally laid aſide. The earthen cullenders, too, do not anſwer any good purpoſe; nor indeed does filtration through paper in general ſucceed well. The conical flannel or canvas bags are greatly preferable: but they have this inconvenience, that the preſſure of the liquor is directed chiefly againſt one particular point, or a ſmall part of the bottom, and therefore the impurities are forcibly driven into that place; and thus the operation becomes inſufferably tedious.

The beſt method of obviating the inconveniences of filtration ſeems to be the following. Let a wooden frame of about three feet ſquare be made, having four holes, one in each corner, about three quarters of an inch in diameter. This frame is to be ſupported by four feet, the ends of which muſt project an inch or two through the holes. Thus the whole may be occaſionally ſet up and taken down ſo as to go into very little compaſs; for if the feet are properly placed, each with a little projection outwards, there will be no danger of its falling. A ſquare piece of canvas muſt alſo be procured, ſomewhat leſs than the wooden frame. On each corner of it there muſt be a very ſtrong loop, which ſlips on one of the projecting ends of the feet, ſo that the canvas may hang a little ſlack in the middle of the frame. The liquor to be filtered is now poured into the canvas, and a veſſel placed underneath to receive it. At firſt it will paſs through very foul; but being returned two or three times will become perfectly tranſparent, and will continue to run with great velocity, if the filter is kept conſtantly full. A filter of the ſize juſt now mentioned will contain ten gallons of liquid; which is a very great advantage, as the heat of ſuch a quantity of liquor is not ſoon diſſipated, and every ſolution filters much faſter when hot than when allowed to cool.

The advantages of a filter of this kind above others ariſe from the preſſure of the liquor being more equally diffuſed over a large ſpace, by which the impurities are not forced ſo ſtrongly into the cloth as to ſtop it up entirely. Yet even here, where large quantities of liquor require filtration, the cloth is apt to be ſtopped up ſo as to make the operation not a little tedious and diſagreeable. It will be proper therefore to have ſeveral cloths, that one may be applied as ſoon as another is taken off.

To promote the operation of filtration, it is very proper to let the liquors to be filtrated ſettle for ſome time; that ſo their groſſer feculencies may fall to the bottom, and thus there will be the fewer to retard the laſt part of the operation. Sometimes, however, theſe feculencies refuſe to ſettle till after a very long time; and where this happens to be the caſe, a little powdered quicklime thrown into the boiling liquor remarkably promotes the ſeparation. This, however, can only be uſed in certain caſes.

569 Schemes for filtering large quantities of water.

In ſome caſes, the diſcovery of a ready way of filtering a large quantity of liquor would be a matter of great conſequence; as where a town is ſupplied with river water, which is generally far from being clear, and often imparts a diſagreeable colour to clothes waſhed with it. Some years ago, a ſcheme was propoſed by a chemiſt for filtering muddy water in any quantity. His method was, to have a large caſk covered over in the bottom with ſtraw to the depth of ſome inches, and then filled up with ſand. This caſk was entirely open at one end, and had a hole in the other, which, by means of a leaden pipe, communicated with a large reſervoir of the water to be filtered, and which ſtood conſiderably higher than the caſk. The water which deſcended through the pipe into the caſk, having a tendency to riſe up to the ſame level with that in the reſervoir, would preſs violently againſt the ſand, and, as he thought, run over the mouth of the caſk perfectly filtrated, and free from its impurities. By this contrivance, indeed, a very violent preſſure was occaſioned, if the height of the reſervoir was conſiderable: but the conſequence was, not a filtration, but a greater degree of impurity in the water; for the ſand was forced out of the caſk along with it, and, however confined, the water always aroſe as muddy as it went in.

Where water is to be filtered in large quantity, as for the purpoſes of a family, a particular kind of ſoft ſpongy ſtones called *filtering ſtones*, are employed. Theſe, however, though the water percolates through them very fine, and in ſufficient quantity at firſt, are liable to be obſtructed in the ſame manner as paper, and are then rendered uſeleſs. A better method ſeems to be, to have a wooden veſſel, lined with lead, three or four feet wide at top, but tapering ſo as to end in a ſmall orifice at the bottom. The under part of the veſſel is to be filled with very rough ſand, or gravel, well freed from earth by waſhing. Over this, pretty fine ſand may be laid to the depth of 12 or 14 inches, but which muſt likewiſe be well freed from earthy particles. The veſſel may then be filled up to the top with water, pouring it gently at firſt, leſt the ſand ſhould be too much diſplaced. It will ſoon filter thro' the ſand, and run out at the lower orifice exceedingly tranſparent, and likewiſe in very conſiderable quantity. When the upper part of the ſand begins to be ſtopped up, ſo as not to allow a free passage to the water, it may occasionally be taken off, and the earthy matter washed from it, when it will be equally serviceable as before.

570 Precipitation. III. Precipitation or Coagulation. This operation is the very reverse of solution, and is the bringing a body suddenly from a fluid to a solid state. It differs from crystallization, in that it generally requires less time; and in crystallization the substance assumes regular figures, whereas precipitates are always in the form of powders.

Precipitation is generally preceded by solution and filtration: it is used for separating earths and metals from the acids which had kept them suspended. When a precipitation is made of the more valuable metals, glass vessels are to be used. When earths, or the imperfect metallic substances, are to be precipitated in large quantity, wooden ones answer every purpose. If a metal is to be precipitated by an alkali, this salt must first be dissolved in water, then filtered, and gradually added to the metallic solution. If particular circumstances do not forbid, the salt for precipitation should be chosen in its caustic state, or deprived of its fixed air, because then a very troublesome effervescence is avoided. To promote the operation also, the mixture, if contained in a glass, is to be shaken; or if in any other vessels, to be well stirred after every addition of alkali. If an earth is employed to precipitate a metal, the mixture must be in a manner constantly stirred or shaken, in order to promote the precipitation; and if one metal is to be precipitated by another, that which is used as a precipitant must be beaten into thin plates, that so they may be frequently cleaned from the precipitating metal, which would otherwise very soon totally impede the operation.

Sometimes a precipitation ensues on the addition of water or spirit of wine: but in most cases care must be taken not to add too much of the substance which is used to precipitate the other; because, in such a case, the precipitate may be dissolved after it has been thrown down. Thus, though volatile alkali will separate copper from aquafortis, it will as effectually dissolve the precipitate, if too much of it is used, as the acid itself. It is proper, therefore, to proceed cautiously, and examine a small quantity of the liquor from time to time. If an addition of the precipitant throws down any more, it will be proper to add some more to the whole solution.

571 Edulcoration. It is seldom or never that precipitation can be performed so perfectly, but that one or other of the ingredients will prevail; and though they should not, a new compound, consisting of the acid united with the alkali, or other substance used for precipitation, is contained in the liquor through which the precipitate falls. It is proper, therefore, to wash all precipitates; otherwise they can never be obtained perfectly pure, or free from a mixture of saline substances. This is best done by pouring the whole into a filter, and letting the fluid part run off, as long as it will drop, without shaking the cloth. Some water is then to be cautiously poured all over the surface of the precipitate, so as to disturb it as little as possible. This water will push before it the saline liquor which is mixed with the powder, and render it much purer than before. A second or third quantity of water may be used, in order to wash off all the saline matter. This is called *edulcorating* the precipitate.

572 Evaporation. IV. Evaporation. This operation consists in dissipating the moist fluid or volatile parts of any substance by means of heat. It most generally succeeds solution and filtration, being a preparatory for the operation of crystallization.

For the evaporation of saline solutions, which have been already filtered, and which it is of consequence to preserve from even the least impurities, distilling vessels are unquestionably the most proper; both as, by their means, the solution will be kept perfectly free from dust, and as the quantity of liquor evaporated can be known with certainty by measuring that which comes over. This also is probably the most expeditious method of evaporating, and which requires the least fuel. (See the detached articles Evaporation and Distillation). With regard to vessels for evaporation, the same thing must be applicable which was mentioned above under *Solution*. No saline liquor must be evaporated in a vessel which would be corroded by it; and hence iron vessels are absolutely improper for evaporations of any kind of saline liquor whatever.—Lead is in this case the metal most generally useful. It must only be used, however, where the evaporation is not carried to dryness; for, on account of the great fusibility of this metal, nothing could be exsiccated in it without great danger of its melting. Where a saline liquor therefore is to be perfectly exsiccated, the evaporation, if performed in lead vessels, must be carried on so far only as to form a saline pellicle on the surface of the liquor. It is then to be drawn off; for which purpose, all evaporating vessels should have a cock near the bottom. The liquor must now be put into a number of stone-ware basons, set on warm sand, where the exsiccation may be finished.

573 Crystallization. V. Crystallization. This, though commonly accounted one of the processes in chemistry, is in reality only a *natural* one, and which the chemist can only prepare for, leaving the operation entirely in the hands of nature.—By crystallization is meant the separation of a salt from the water in which it has been dissolved, in transparent masses regularly figured, and differently formed, according to the different nature of the salts.

This process depends upon the constitution of the atmosphere more than any other; and therefore is difficult to be performed, nor does it always succeed equally well; neither have there yet been laid down any rules whereby beautiful and regular crystals can with certainty be formed at all times.

As the different salts assume very different figures when crystallized, they are not subject to the same general rules in crystallization. Nitre, Glauber's salt, vitriol of iron, and many others, crystallize best on having their solutions set in a cold place after proper evaporation. Sal polychrest, and common salt, require the solution to be kept as hot as the hand can bear it during the time of crystallizing. Soluble tartar too, and other deliquescent salts, require to be kept warm while this operation is going on: and there are many saline substances, such as the combinations of calcareous earths and magnesia with acids, which can scarcely be crystallized at all.

Mr Beaumé has discovered, that when two or more salts

Chemical Operations salts are diſſolved in the ſame quantity of water, when one cryſtallizes, the cryſtals of that ſalt will not contain the leaſt quantity of any of the others: neither, although the liquor was acid or alkaline, will the cryſtals for that reaſon be either acid or alkaline, but will remain perfectly neutral; and the acid or alkaline liquor which adheres to the outſide of the cryſtals may be abſorbed by merely ſpreading them on filtering paper.—Hence we are furniſhed with a better method of ſhooting ſalts into large and well formed cryſtals than merely by diſſolving them in water; namely, by adding to the ſolutions, when ſet to cryſtallize, a certain quantity of acid or alkaline liquor, according to the nature of the ſalts themſelves. Theſe additions, however, are not equally proper for all ſalts; and it is not yet determined what kinds of ſalts ought to be cryſtallized in alkaline, and what in acid liquors.—Soluble tartar and Seignette's ſalt cryſtallize beſt when the liquor is alkaline. Sal ſedativus, ſal Glauberi, and ſal polychreſt, require an acid if cryſtallized in the cold; but ſal polychreſt forms into very fine and large cryſtals when the ſolution is alkaline, and kept as hot as the hand can eaſily bear.

The beſt general direction that can be given with regard to the regular cryſtallization of ſalts is, that they ought to be ſet to cryſtallize in as large a quantity at once as poſſible; and this, as far as we have obſerved, without any limit; for by this means, the cryſtals are formed much larger and better figured than they poſſibly can be by any other method hitherto known.—As to the form of the veſſels in which ſalts are to be cryſtallized, little can be ſaid with certainty. They are generally flat, and wider at top than at the bottom. The only proper material, in the large way, is lead.

574 Diſtillation. VI. Distillation. This is a kind of evaporation; only in ſuch a manner, that the part of the liquor evaporated is not diſſipated in the air, but preſerved by making the ſteam paſs through a ſpiral pipe, which goes through a large veſſel full of cold water, or into cold glaſs receivers.

This is one of the moſt common chemical operations; and as there are a variety of ſubjects which require to be diſtilled, there is conſequently a conſiderable variety both in the form of the diſtilling veſſels to be uſed on different occaſions, and likewiſe in the materials of which they are made, as well as the management of the fire during the time of the operation.

Plate CXXXIV. The moſt ſimple and eaſily performed diſtillation is that by the common copper ſtill, (fig. 3). It conſiſts of two parts; one called the *body*, and the other the *head*. The body is a cylindrical veſſel of copper, which is ſometimes tinned over in the inſide; but where diſtillation is performed without any regard to the reſiduum, the tinning is uſeleſs. The upper part of the body terminates in a kind of arch, in the middle of which is a circular aperture, about one half, or ſomething leſs, in diameter, of the breadth of the whole body.—Into this aperture, a round head, made likewiſe of copper, is fitted, ſo as to be removeable at pleaſure. In the top, or ſometimes in the ſide of the head, is inſerted a pewter pipe, which communicates with a ſpiral one of the ſame metal, that paſſes through a large wooden veſſel, called the *refrigeratory*, filled with cold water; each of its ends projecting a little above and below. The ſtill is to be filled two-thirds full of the ſubſtance to be diſtilled, the head put on, and the junctures well cloſed with mixture of lintſeed meal and water, or common flour or chalk and water will anſwer the ſame purpoſe. This mixture is called the *luting*, or *lute*. A fire being kindled under the ſtill, the vapours will ariſe; and, being condenſed by the cold water, through which the ſpiral pipe called the *worm* paſſes, will run in a ſtream more or leſs ſtrong as the fire is more or leſs haſtily urged, and is catched in a receiver ſet underneath.

This kind of diſtilling veſſels is proper for procuring the eſſential oils of vegetables, vinous ſpirits from fermented liquor, and for the rectification of theſe after they are once diſtilled. Even the acetous acid may be very conveniently diſtilled in a copper veſſel, provided the worm and all the deſcending parts of the pipe which communicates with it be of pewter, otherwiſe a miſchievous impregnation of copper would be communicated to the diſtilled vinegar. The reaſon of this is, that copper is not diſſolved by vinegar, or in very ſmall quantity, when that acid is boiled in it; but if the metal is expoſed to the action of the acid, when cold, or to its vapours, a conſiderable diſſolution takes place. For this reaſon, too, the ſtill muſt be waſhed out after the operation while it continues hot, and muſt be very carefully freed from the leaſt remains of acid, otherwiſe it will be much corroded.

Copper-ſtills ought to be of as large a ſize as poſſible: but Dr Lewis very juſtly obſerves, that, in common ones, the width of the worm is by no means proportionable to the capacity of the ſtill: hence the vapour which iſſues from a large ſurface being violently forced through a ſmall tube, meets with ſo much reſiſtance as ſometimes to blow off the ſtill-head. This inconvenience is ridiculouſly endeavoured to be prevented by ſtrongly tying or otherwiſe forcing down the head; by which means, if the worm ſhould happen to be choaked up, a terrible exploſion would enſue: for no ligatures, or any other obſtacle whatever, have yet been found ſtrong enough to reſiſt the elaſtic force of ſteam, and the greater obſtacle it has to overcome, the greater would the exploſion be.—Dangers of this kind might be totally avoided by having the worm of a proper degree of wideneſs.

575 Mineral acids how diſtilled. Sometimes, however, matters are to be diſtilled, ſuch as mineral acid ſpirits, which would corrode any kind of metalline veſſels; and for theſe only earths, or the cloſeſt kind of ſtone-ware, can be uſed. Theſe are more eaſily condenſed than the ſteams of aqueous or vinous liquors, and therefore do not require to be paſſed through a pipe of ſuch a length as is uſed for condenſing the ſteams from the common ſtill. In theſe caſes, where a violent heat is not neceſſary, and the diſtillation is to be performed in glaſs veſſels, the retort is uſed (fig. 4.) When a fluid is to be put into this veſſel, the retort muſt be laid upon its back on ſand, or any other ſoft matter that will ſupport it without breaking. A funnel muſt alſo be procured with a long ſtem, and a little crooked at the extremity, that the liquor may paſs at once into the belly of the retort, without touching any part of its neck; otherwiſe the quantity which adhered to the neck would paſs into the receiver when the retort was placed in a proper ſituation for diſtilling, and foul the produce. When the veſſel is properly filled, which ought never to be above two-thirds, it is to be ſet in a ſand-bath: that is, in an iron pot, of a proper thickneſs, 576 Retort.

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ness, and covered over in the bottom, to the deph of one or two inches, with dry sand. When the retort is put in, so as to stand on its bottom, the pot is to be filled up with sand, as far as the neck of the retort. A glass receiver is then to be applied, which ought to be as large as possible, and likewise pretty strong; for which reason it will be proper not to let the capacity of it be above what is necessary to hold ten gallons. In the hinder part of it should be drilled a small hole, which may be occasionally shut by a small wooden peg. The mouth of the receiver ought to be so wide as to let the nose of the retort enter to the middle of it, or very near to it; for if the vapours are discharged very near the luting, they will act upon it much more strongly than when at a distance. It is likewise proper to have the neck of the retort as wide as may be; for this has a very great effect in the condensation, by presenting a larger surface to the condensing vapour.

577 Luting for acid spirits.

The luting for acid spirits ought to be very different from that used in other distillations; for these will penetrate the common lutes so as to make them liquid and fall down into the receiver. Some have used retorts the necks of which were ground to the receivers with emery; but these are very difficult to be procured, and are expensive, and consequently have never come into a general use. Various kinds of lutes have been proposed, but the preference seems due to a mixture of clay and sand. We are not to understand, however, that every kind of clay is fit for this purpose: it must only be such as is not at all, or very little, affected by acids; and this quality is only possessed by that kind of which tobacco-pipes is made. Trial ought to be made of this before the distillation is begun, by pouring a little nitrous acid on the clay intended to be made use of. If a violent effervescence is raised, we may be sure that the clay is unfit for the purpose. Finely powdered alabaster would answer extremely well, had it the ductility of clay. As this kind of lute remains soft for a considerable time, it ought to be farther secured by a bit of rag spread with some strong cement, such as quicklime mixed with the white of an egg, *&c.* Matters, however, ought to be managed in such a manner, that the luting may give way, rather than the vessel burst; which would not only occasion a certain loss of the materials, but might endanger the persons who are standing by.

578 *Balneum arenæ.*

The iron pots commonly used for distillations by the sand-bath, or *balneum arenæ*, are commonly made very thick; and are to be sold at large founderies, under the name of *sand-pots*. The shape of these, however, is by no means eligible: for, as they are of a figure nearly cylindrical, if the retort is of such a size as almost to fill their cavity, it cannot be put into them when full, and often pretty heavy, without great danger of touching the sides of the pot; and in this case, touching and *breaking* are synonymous expressions. It is much better, therefore, to have them in the figure of a punch-bowl; and the common cast-iron kettles, which may be had much cheaper than the sand-pots usually sold, answer extremely well. If the distilling vessel is placed in a pot filled with water, the distillation is said to be performed in a water-bath, or *balneum mariæ*.

When the matter to be condensed is very volatile, a number of open receivers with two necks, called *adopters* (fig. 7.) may be used, with a close receiver at the end. Each of these adopters must be luted with as much care as when only a single receiver is made use of. Vessels of a similar kind were formerly much used by chemists for particular sublimations, under the name of *aludels*.

579 Adopters of aludels.

Formerly, instead of retorts, a vessel called a *cucurbit*, (fig. 5, and 6.) with a head like the common still, called an *alembic*, were used; but the more simple figure of the retort gives it greatly the preference. It is but seldom that vessels of this kind are useful, which will be taken notice of when describing the particular operations; and if at any time an alembic head should be necessary, its use may be superseded by a crooked glass tube, which will answer the purpose equally well.

Sometimes a very violent fire is required in distillations by the retrot. Here, where it is possible, glass or earthen vessels should be avoided, and iron pots substituted in their stead. The hardest and best cast iron, however, will at last melt by a vehement heat; and therefore there is a necessity for using earthen ware, or coated glass. This last is better than most kinds of earthen ware, as being less porous; for when the vessel is urged by a very intense heat, the glass melts, and forms a kind of semivitreous compound with the inside of the coating, so that its figure is still preserved, and the accidental cracks in the luting are filled up.

580 Coating of glasses.

For coating of vessels, mixtures of colcothar of vitriol, sand, iron filings, blood, chopped hair, *&c.* have been recommended. We cannot help thinking, however, that the simple mixture of tobacco-pipe clay and sand is preferable to any other; especially if, as Dr Black directs, that part next the glass is mixed with charcoal dust.

The proportions recommended by the Doctor for luting the joints of vessels, are four parts of sand and one of clay; but for lining the insides of furnaces, and we should think, likewise for coating glass vessels, he directs 6 or 7 of sand to 1 of clay, that the contraction of the clay in drying may thereby be the more effectually prevented. Besides this, he directs a mixture of three parts of charcoal-dust with one of clay to be put next the furnace itself, as being more apt to confine the heat; but possibly the first composition might be sufficient for glasses.

The coating of large glasses must be a very troublesome and tedious operation; and therefore coated glass is never used but in experiments. When large distillations are to be performed in the way of trade, recourse must be had either to iron pots, or to earthen ware. Of the most proper kinds of earthen ware for resisting violents heat, we shall take notice under the article *Fusion*.

In all distillations by the retort, a considerable quantity of air, or other incondensible vapour, is extricated; and to this it is absolutely necessary to give vent, or the vessel would be burst, or the receiver thrown off. For this purpose, Dr Lewis recommends an open pipe to be inserted at the luting, of such an height as will not allow any of the vapour to escape; but this we cannot approve of, as by that means a constant communication is formed between the external atmosphere and the matters contained in the retort and receiver, which is at all times to be avoided as much as possible, and in some cases, as the distillation of phosphorus, would be very dangerous. The having a small

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small hole drilled in the receiver, which is to be now and then opened, must answer the purpose much better, although it takes more attendance; but if the operator is obliged to leave the vessels for some time, it will be convenient either to leave the little hole open, or to contrive it so that the wooden peg may be pushed out with less force than is sufficient to break the lute.

581 Sublimation.

VII. Sublimation. This, properly speaking, is only the distillation of a dry substance; and therefore, when volatile matters, such as salt of hartshorn, are to be sublimed, the operation is performed in a glass retort set in a sand-bath; and the salt passes over into the receiver. The cucurbit and alembic were formerly much in use for this purpose; and a blind head, without any spout, was applied. A much simpler apparatus, however, is now made use of. A globe made of very thin glass, or an oblong vessel of the same kind, answers the more common purposes of sublimation. For experiments, Florence flasks are excellent: as being both very cheap, and having the necessary shape and thinness requisite for bearing the heat without cracking. The matter to be sublimed must not, on almost any occasion, take up more than a third part of the subliming vessel. It is to be set in a sand-bath, that the heat may be more equally applied than it could otherwise be. The heat must be no greater, or very little, than is necessary for sublimation, or it will be in danger of flying out at the mouth of the subliming vessel, or of choaking it up so as to burst. The upper part of the vessel, too, must by no means be kept cool, but slightly covered with sand, that the matter may settle in a kind of half melted state, and thus form a compact hard cake, which is the appearance sublimates are expected to have. Hence this operation requires a good deal of caution, and is not very easily performed.

582 Deflagration.

VIII. Deflagration. This operation is always performed by means of nitre, except in making the flowers of zinc. It requires open vessels of earth or iron; the latter are very apt to be corroded, and the former to imbibe part of the matter. To perform this process with safety, and without loss, the nitre ought to be mixed with whatever matter is to be deflagrated with it, and thrown, by little and little into the vessel previously made red-hot. If much is put in at once, a great deal will be thrown out by the violent commotion; and to perform this operation in close vessels is in a manner impossible, from the prodigious quantity of elastic vapour generated by the nitre. Care must also be taken to remove the whole mixture to some distance from the fire, and not to bring back any spark from the quantity deflagrating, with the spoon which puts it in; otherwise the whole would irremediably be consumed at once.

583 Calcination.

IX. Calcination. This is the subjecting any matter to a heat so violent as to dissipate some part of it, without melting what remains. It is often practised on metallic substances, particularly lead, for obtaining the calx of that metal called *minium*, or red lead.

This operation, as indeed all other chemical ones, is best performed in large quantities, where a particular furnace is constructed on purpose, and a fire kept on day and night without interruption. The flame is made to play over the surface of the metal, and it is continually stirred so as to expose different parcels of it to the action of the heat.

584 Fusion.

X. Fusion. This is when a solid body is exposed to such a degree of heat as makes it pass from a solid to a fluid state; and as different substances are possessed of very different degrees of fusibility, the degrees of melting heat are very various.

Besides the true fusion, there are some kinds of salts which retain so large a proportion of water in their crystals, as to become entirely fluid upon being exposed to a very small degree of heat. This is commonly called the *watery fusion*; but is really a *solution* of the salt in that quantity of water retained by it in its crystalline form: for such salts afterwards become solid by the evaporation of the water they contained: and then require a strong red heat to melt them thoroughly, or perhaps are absolutely infusible.

Of all known substances, unctuous and inflammable ones become fluid with the least heat: then come the more fusible metals, lead, tin, and antimony; then some of the more fusible salts; and then the harder metals, silver, gold, copper, and iron; then the mixtures for making glass; and last of all, the metal called *platina*, which has hitherto been incapable of fusion, except by the violent action of the sun-beams in the focus of a large burning glass. This substance seems to be the most refractory of all others, even the hardest flints melting into glass long before it. (See Platina.)

Fusion of small quantities of matter is usually performed in pots called *crucibles*; which, as they are required to stand a very violent heat, must be made of the most refractory materials possible.

585 Crucibles, proper materials for.

The making of crucibles belongs properly to the potter: but as a *chemist* ought to be the judge of their composition, we shall here give some account of the different attempts to make these vessels of the necessary strength.

All earthen vessels are composed, at least partly, of that kind which is called the *argillaceous earth* or *clay*, because these only have the necessary ductility, and can be formed into vessels of the proper form. Pure clay is, by itself, absolutely unfusible; but is exceedingly apt to crack when exposed to sudden changes of heat and cold. It is also very apt to melt when mixed with other substances, such as calcareous earths, &c. When mixed in a certain proportion with other materials, they are changed with violent heat into a kind of half-melted substance, such as our stone-bottles. They cannot be melted completely, however, by almost any fire; they are also very compact, and will contain the most fusible substances, even glass of lead itself; but as they are very apt to crack from sudden changes of heat and cold, they are not so much used; yet, on particular occasions, they are the only ones which can be made use of.

The more dense any kind of vessels are, the more apt they are, in general, to break by a sudden application of heat or cold: hence crucibles are not, in general, made of the greatest density possible: which is not at all times required. Those made at Hesse, in Germany, have had the best reputation for a long time. Mr Pott, member of the Academy of Sciences at Berlin, hath determined the composition of these crucibles to be, one part of good refractory clay, mixed with two parts of sand, of a middling fineness, from which the finest part has been sifted. By sifting the finer particles from the sand, too great compactness is avoided: but

but at the ſame time this mixture renders them apt to be corroded by vitrifying matters kept a long time in fuſion; for theſe do not fail to act upon the ſand contained in the compoſition of the crucible, and, forming a vitreous maſs, at laſt run through it.

This inconvenience is prevented, by mixing, inſtead of ſand, a good baked clay in groſs powder. Of a compoſition of this kind are made the glaſs-houſe pots, which ſometimes ſuſtain the violent heat employed in making glaſs for ſeveral months. They are, however, gradually conſumed by the glaſs, and become conſtantly more and more thin.

586 **Platina, a deſirable material.**

As the containing veſſel, however, muſt always be expoſed to a more violent heat than what is contained in it, crucibles ought to be formed of ſuch materials as are not vitrifiable by the heat of any furnace whatever. But from the attempts made to melt platina, it appears, that of all known ſubſtances it would be the moſt deſirable for a melting veſſel. Heſſian crucibles, glaſs-houſe pots, Sturbridge clay, in ſhort every ſubſtance which could be thought of to reſiſt the moſt violent heat, were melted in ſuch a manner as even to ſtop up the pipes of large bellows, while platina was not altered in the leaſt; and Meſſrs Macquer and Beaume have ſhown, that though platina cannot be melted ſo as to caſt veſſels of it, it may nevertheleſs be cupelled with lead ſo as to become malleable, and thus veſſels might otherwiſe be made from that ſubſtance.

587 **Achard's method of making crucibles of platina.**

The extreme ſcarcity of this mineral, however, leaves as yet little room to hope for any thing from it, though Mr Achard has found a method of forming crucibles from this refractory ſubſtance. It conſiſts in moulding the precipitate made with ſal ammoniac into the form of a crucible, and then applying a ſudden and very violent heat, which fuſes this calx.

Mr Pott has made ſo many experiments upon clays mixed with different ſubſtances, that he has in a manner exhauſted the ſubject. The baſis of all his compoſitions was clay. This he mixed in different proportions with metallic calces, calcined bones, calcareous earths, talcs, amianthus, aſbeſtus, pumice-ſtones, tripoli, and many others; but he did not obtain a perfect compoſition from any of them. The beſt crucibles, according to Scheffer, cannot eaſily contain metals diſſolved by ſulphur, in the operation of parting by means of ſulphur. They may be made much more durable and ſolid, by ſteeping them a few days in linſeed-oil, and ſtrewing powdered borax upon them before they are dried.

588 **Mr Pott's directions.**

The reſult of Mr Pott's experiments are: 1. Crucibles made of fat clays are more apt to crack when expoſed to ſudden heat, than thoſe which are made of lean or meagre clays. *Meagre clays* are thoſe which contain a conſiderable quantity of ſand along with the pure argillaceous earth: and *fat clays* are thoſe which contain but little. 2. Some crucibles become porous by long expoſure to the fire, and imbibe part of the contained metals. This may be prevented, by glazing the internal and external ſurfaces; which is done by moiſtening theſe with oil of tartar, or by ſtrewing upon them, when wetted with water, powdered glaſs of borax. Theſe glazings are not capable of containing glaſs of lead. 3. Crucibles made of burnt clay groſsly powdered, together with unburnt clay, were much leſs liable to crack by heat than crucibles made of the ſame materials where the burnt clay was finely powdered, or than crucibles made entirely of unburnt clay. 4. If the quantity of unburnt clay be too great, the crucible will be apt to crack in the fire. Crucibles made of 10 ounces of unburnt clay, 10 ounces of groſsly powdered burnt clay, and three drachms of calcined vitriol, are capable of retaining melted metals, but are pervaded by glaſs of lead. The following compoſition is better than the preceding: Seven ounces of unburnt clay, 14 ounces of groſsly powdered burnt clay, and one drachm of calx of vitriol. Theſe crucibles may be rendered more capable of containing glaſs of lead, by lining their internal ſurfaces, before they are baked, with unburnt clay diluted with water. They may be further ſtrengthened by making them thicker than is uſually done; or by covering their external ſurfaces with ſome unburnt clay, which is called *arming* them.

589 **Materials moſt capable of reſiſting glaſs of lead.**

5. The compoſition of crucibles moſt capable of containing the glaſs of lead, was 18 parts of groſsly powdered burnt clay, as much unburnt clay, and one part of fuſible ſpar. Theſe crucibles muſt not, however, be expoſed too ſuddenly to a violent heat. 6. Crucibles capable of containing glaſs of lead very well, were made of 24 parts of unburnt clay, four parts of burnt clay, and one part of chalk. Theſe require to be armed. 7. Plume alum powdered, and mixed with whites of eggs and water, being applied to the internal ſurface of a Heſſian crucible, enabled it to retain for a long time glaſs of lead in fuſion. 8. One part of clay, and two parts of Spaniſh chalk, made very good crucibles. The ſubſtance called *Spaniſh chalk* is not a calcareous earth, but appears to be a kind of ſteatites. 9. Two parts of Spaniſh chalk, and one part of powdered tobacco-pipes, made good lining for common crucibles. 10. Eight parts of Spaniſh chalk, as much burnt clay, and one part of litharge, made ſolid crucibles. 11. Crucibles made of black lead are fitter than Heſſian crucibles for melting metals; but they are ſo porous, that fuſed ſalts paſs entirely thro' them. They are more tenacious than Heſſian crucibles, are not ſo apt to burſt in pieces, and are more durable. 12. Crucibles placed with their bottoms upwards, are leſs apt to be cracked during the baking, than when placed differently. 13. The paſte of which crucibles are made, ought not to be too moiſt; elſe, when dried and baked, they will not be ſufficiently compact: hence they ought not to be ſo moiſt as to be capable of being turned on a potter's lathe; but they muſt be formed in braſs or wooden moulds.

590 **Dr Lewis's obſervations.**

On this ſubject Dr Lewis hath alſo made ſeveral obſervations; the principal of which are, 1. Pure clay ſoftened to a due conſiſtence for being worked, not only coheres together, but ſticks to the hands. In drying, it contracts 1 inch or more in 12; and hence it is very apt to crack, unleſs it is dried exceeding ſlowly. In burning, it is ſubject to the ſame inconvenience, unleſs very ſlowly and gradually heated. When thoroughly burnt, if it has eſcaped thoſe imperfections, it proves ſolid and compact; and ſo hard as to ſtrike fire with ſteel. Veſſels made of it are not penetrated by any kind of liquid; and reſiſt ſalts and glaſſes brought into the thinneſt fuſion, excepting thoſe which by degrees corrode and diſſolve the earth itſelf, as glaſs of lead; and even this penetrating glaſs is reſiſted by it better than by almoſt any other earth; but, in counterbalance to theſe good qualities, they cannot be heated or cooled, but with ſuch precautions as can

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rarely be complied with in the way of business, without cracking, or flying in pieces.

2. Clay that has been once exposed to any considerable degrees of heat, and then powdered, has no longer any tenacity. Fresh clay, divided by a due proportion of this powder, proves less tenacious than by itself; not sticking to the hands, though cohering sufficiently together. It shrinks less in drying, is less apt to crack, and less susceptible of injury from alterations of heat and cold; but at the same time is less solid and compact. Considerable differences are observed in these respects; not only according to the quantity of dividing matter, but according as it is in finer or coarser powder.

3. Vessels made with a moderate proportion of fine powder, as half the weight of the clay, are compact and solid, but still very apt to crack, from sudden heat or cold: those with a larger proportion, as twice or thrice the quantity of the clay, are free from that imperfection, but so friable as to crumble between the fingers. Nor does there appear to be any medium between a disposition to crack and to crumble; all the compounds made of clay and fine powders having the one or the other, or both imperfections. Coarser powders of the size of middling sand, form, with an equal weight of clay, compounds sufficiently solid, and much less apt to crack than the mixtures with fine powders. Two parts of coarse powder, and one of clay, prove moderately solid, and but little disposed to crack: a mixture of three parts and one, tho' heated and cooled suddenly, does not crack at all, but suffers very fluid substances to transude through it; solidity, and resistance to quick vicissitudes of heat and cold, seeming here also to be incompatible.

4. Pure clay, mixed with pure clay that has been burnt, is no other than one simple earth; and is neither to be melted nor softened, nor made in any degree transparent with the most intense fires.

5. Mixtures of clay with gypseous earths burn whiter than clay alone; in certain proportions, as two parts of clay to three of gypsum, they become, in a moderate fire, semi-transparent, and in a strong one they melt.

6. Calcareous earths in small proportion bake tolerably compact and white; and added to other compositions, seem to improve their compactness. If the quantity of the calcareous earth nearly equals that of the clay, the mixture melts into a yellow glass; if it considerably exceeds, the product acquires the qualities of quicklime.

7. Vessels made from clay and sand, in whatever proportion, do not melt in the strongest fire; but they sometimes bend or soften, so as to yield to the tongs. Glasses in thin fusion penetrate them by dissolving the sand. If gypseous or calcareous earths e urged in such crucibles with a vehement heat, the vessels and their contents run all into one mass. In moderate fires, these vessels prove tolerably compact, and retain most kinds of salts in fusion: but they are liable to crack, especially when large; and do not long sustain melted metals, being burst by their weight. Such are the Hessian crucibles.

8. Mixtures of clay and black-lead, which seems a species of talc, are not liable to crack from alternations of heat and cold; but are extremely porous. Hence black-lead crucibles answer excellently for the melting of metals, and stand repeated fusions; whilst salts flowing thin, transude through them almost as water through a sieve: sulphureous bodies, as antimony, corrode them.

9. Pure clay, softened with water, and incrustated on earthen vessels, that have been burnt, does, not adhere to them, or scales off again upon exposure to the fire; applied to unburnt vessels, it adheres and incorporates. Divided clay unites with them in both states. Vitreous matters, melted in vessels of pure clay, adhere so firmly as not to be separated; from vessels of divided clay they may be knocked off by a hammer.

10. The saline fluxes which promote the fusion of clay, besides the common ones of all earths, alkali and borax, are chiefly arsenic fixed by nitre, and the fusible salt of urine; both which have little effect on the other earths though mixed in a lager proportion. Nitre, which readily brings the crystalline earths into fusion, and sal mirabile and sandiver, powerful fluxes for the calcareous earths, do not perfectly vitrify with clay. Burnt clay does not differ in these respects from such as has not been burnt; nor in that singular property of vitrifying with gypseous or calcareous earths, without any saline or metallic addition; the utmost vehemence of fire seeming to destroy only its ductility, or that power by which it coheres when its parts are moistened with water.

But though it seems impossible to make perfect vessels from mixtures of clay in its two different states, of burnt and unburnt, more is to be hoped from the mixtures which are employed in making porcelain. Manufactories of this kind of ware have been attempted in different countries, (see PORCELAIN); and in some places the qualities requisite for chemical vessels have been given to it in a very surprising degree. The count de Lauraguais, a French nobleman, and member of the academy of sciences, has distinguished himself in a very eminent manner by attempts of this kind. The translator of the chemical dictionary assures us, that he had it from a gentleman of undoubted veracity, that this nobleman having heated a piece of his porcelain red hot, threw it into cold water, without breaking or cracking it. 591 More perfect vessels to be hoped for from porcelain.

The most useful attempt, however, for the purposes of chemistry, seems to be the discovery by Mr Reaumur of converting common green glass into porcelain. This was published as long ago as the year 1739; yet we have scarce heard of any chemist, no not Dr Lewis himself, who has made trial of chemical vessels formed of this sort of porcelain, although the very use to which Mr Reaumur thought the preparation could be applicable was that of bringing chemical vessels to a degree of perfection which could not otherwise be done. The following is the result of Mr Reaumur's experiments. 592 Mr Reaumur's porcelain.

Green glass, surrounded with white earthy matters, as white sand, gypsum, or plaster of Paris, &c. and exposed to a considerable heat not strong enough to alter its figure, as that of a potter's furnace, acquires different shades of blue, and by degrees begins to grow white. On breaking the glass, the white coat appears to be composed of fine, white, glossy, satin-like fibres, running transversely, and parallel to one another; the glass in the middle being scarcely altered. On continuing the cementation, the change proceeds further and further, till at length the white fibrous parts

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parts from both sides meet in the middle, and no appearance of glass remains. By this means, entire vessels of glass may be changed into procelain.

The substance into which glass is thus converted, is opaque, compact, internally of great whiteness, equal to that of the finest china-ware; but, externally, of a much duller hue. It is considerably harder than glass, much less fusible in the fire, and sustains alterations of heat and cold without injury. Vessels of it, cold, bear boiling liquors; and may be placed on the fire at once, without danger of their cracking. "I have put a vessel of this porcelain (says the author) into a forge, surrounded it with coals, and kept vehemently blowing for near a quarter of an hour; I have melted glass in this vessel, without its having suffered any injury in its figure." If means could be found of giving the outside a whiteness, equal to the internal part, glass vessels might thus be converted into a valuable kind of porcelain superior to all that have hitherto been made. Chemistry, says he, may receive from this discovery, in its present state, such vessels as have been long wanted; vessels which, with the compactness and impenetrability of glass, are also free from its inconveniences.

The common green glass bottles yield a procelain of tolerable beauty; window-glasses, and drinking-glasses, a much inferior one; while the finer kinds of crystalline glasses afforded none at all. With regard to the cementing materials, he found white sand and gypsum, or rather a mixture of both, to answer best. Coloured earths generally make the external surface of a deeper or lighter brown colour; soot and charcoal, of a deep black, the internal part being always white.

593 Dr Lewis's experiments.

The account of this kind of porcelain given by Mr Reaumur, induced Dr Lewis, who had also observed the same changes on the bottom of glass-retorts exposed to violent heat in a sand-bath, to make further experiments on this matter; an account of which he has published in his *Philosophical Commerce of Arts*. The results of his experiments were, 1. Green glass, cemented with white sand, received no change in a heat below ignition. 2. In a low red heat, the change proceeded exceeding slowly; and in a strong red heat, approaching to white, the thickest pieces of glass bottles were thoroughly converted in the space of three hours. 3. By continued heat, the glass suffered the following progressive changes: first, its surface became blue, its transparency was diminished, and a yellowish hue was observable when it was held between the eye and the light. Afterwards it was changed a little way on both sides into a white substance, externally still bluish; and, as this change advanced still further and further within the glass, the colour of the vitreous part in the middle approached nearer to yellow: the white coat was of a fine fibrous texture, and the fibres were disposed nearly parallel to one another, and transverse to the thickness of the piece: by degrees the glass became white and fibrous throughout, the external bluishness at the same time going off, and being succeeded by a dull whitish or dun colour. By a still longer continuance in the fire, the fibres were changed gradually from the external to the internal part, and converted into grains; and the texture was then not unlike that of common porcelain. The grains, at first fine and somewhat glossy, became by degrees, larger and duller; and at last the substance of the glass became porous and friable, like a mass of white sand slightly cohering. 4. Concerning the qualities of this kind of porcelain, Dr Lewis observes, that, while it remained in the fibrous state, it was harder than common glass, and more able to resist the changes of heat and cold than glass, or even porcelain; but, in a moderate white heat, was fusible into a substance not fibrous, but vitreous and smooth, like white enamel; that when its texture had become coarsely granulated, it was now much softer and unfusible: and lastly, that when some coarsely granulated unfusible pieces, which, with the continuance of a moderate heat, would have become porous and friable, were suddenly exposed to an intense fire, they were rendered remarkably more compact than before; the solidity of some of them being superior to that of any other ware.

594 This subject still imperfect.

It seems surprising that this able chemist, who on other occasions had the improvements of the arts so much at heart, did not put some vessels of this kind of porcelain to other severe trials, besides attempting to fuse it by itself with a violent fire: for though pieces of it were absolutely unfusible, we are not sure but they might have been corroded by alkaline salts, acids, calcareous earths, or glass of lead; nay, it should seem very probable that they would have been so: in which case they would not be much superior to the vessels made from earthy materials. When a first-rate chemist publishes any thing in an imperfect state, inferior ones are discouraged from attempting to finish what he has begun; and thus, notwithstanding that these experiments have been so long published, nobody has yet attempted to investigate the properties of this kind of porcelain, by getting chemical vessels made of it, and trying how they answer for crucibles, or retorts.

All that has been said concerning the proper materials for crucibles, must likewise be applicable to the materials for retorts, which are required to stand a very violent heat. Mr Reaumur's porcelain bids fairest for answering the purpose of retorts as well as crucibles. The great disadvantage of the common, earthen ones, is, that they suffer a quantity of volatile and penetrating vapours to pass through them. This is very observable in the distillation of phosphorus; and though this substance has not hitherto been used for any purpose in medicine, and very little in the arts, its acid only being sometimes used as a flux, if vessels could be made capable of confining all the steams and at the same time bearing the heat necessary for its distillation, phosphorus, perhaps, might be obtained in such quantity, as to show that it is a preparation not altogether useless.

595 [596] Stone-ware vessels corroded.

With regard to stone-ware vessels, and all those into which the composition of sand or flint enters, we shall only further observe, that they will be corroded by fixed alkaline salts, especially of the caustic kind, in a very moderate heat. Dr Black, having evaporated some caustic ley in a stone-ware bason, and then melted the dry salt in the same vessel, found it so corroded, as afterwards to be full of small holes; and he found nothing to resist the action of this salt so well as silver. On the subject of chemical vessels, we have now, however, to add the improved earthen ware of Mr Wedgewood; in which the properties of compactness, infusibility and the power of resisting sudden changes of heat and cold, are said to be united, so that it promises to be a very valuable addition to the chemical apparatus.

597 Wedgewood's ware.

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598 Maceration.

11. MACERATION, or DIGESTION. This is the mixing two bodies, generally a solid and a fluid, together, and then exposing them to a moderate degree of heat for a considerable length of time, that so they may have the better opportunity of acting upon one another. Digestion is usually performed in the glasses already mentioned, called *matrasses* or *bolt-heads;* and is done in a sand-heat. When any of the substances are very volatile, as spirit of wine; or when the matter requires to be heated so considerably that a quantity of vapour will be raised, the necks of the bolt-heads ought to be pretty long; or a tin pipe may be inserted, of sufficient length to prevent the escape of any part of the steam.

599 Levigation.

12. LEVIGATION. This is the reducing any body to a very fine powder, which shall feel quite soft between the fingers or when put into the mouth. It is performed by grinding the substance upon a flat marble stone, with some water, or by rubbing it in a marble mortar. In the large way, levigation is performed by mills drawn by horses, or driven by water; some of them are so small as to be turned by the hand. They consist of two smooth stones, generally of black marble, or some other stone equally hard, having several grooves in each, but made to run in contrary directions to one another when the mill is set in motion. The matter being mixed with water, is put in by a funnel, which is fixed into a hole in the upper stone, and turns along with it. The under milstone has round it a wooden ledge, whereby the levigating matter is confined for some time, and at length discharged, by an opening made for that purpose, when it has accumulated in a certain quantity.

In this operation, when the matters to be levigated are very hard, they wear off a part of the mortar, or stones on which they are levigated; so that a substance perfectly hard, and which could not be worn by any attrition, is as great a desideratum for the purposes of levigation, as one which could not be melted is for those of fusion. Dr Lewis proposes the porcelain of Mr Reaumur as an improvement for levigating planes, mortars, *&c.* because, while in its fibrous state, it is considerably harder than glass, and consequently much less liable to abrasion by the harder powders.

In many cases levigation is very much accelerated by what is called *elutriation*. This is the method by which many of the painters colours are prepared of the requisite fineness; and is performed by mixing any substance not totally reduced to the necessary degree of fineness, with a sufficient quantity of water, and stirring them well together. The finer parts of the powder remain some time suspended in the water, while the grosser particles fall to the bottom. The separation is then easily made, by pouring off the water impregnated with these fine parts, and committing the rest to the levigating mill, when it may again be washed; and this may be repeated till all the powder is reduced to the utmost fineness. Substances soluble in water cannot be levigated in this manner.

### Of Chemical Furnaces.

THE two general divisions we have already mentioned of those who practice chemistry, namely, those who have no other view than mere experiment, and those who wish to profit by it, render very different kinds of furnaces necessary. For the first, those furnaces are necessary which are capable of acting upon a small quantity of matter, yet sufficient for all the changes which fire can produce from simple digestion to the most perfect vitrification. For the others, those are to be chosen which can produce the same changes upon very large quantities of matter, that as much may be done at once as possible.

600 Portable furnace.

To avoid the trouble and expence of a number of furnaces, a portable one hath long been a desideratum among those chemists who are fond of making experiments. One of the best of those, if not the very best, that hath yet appeared, is that described in Shaw's edition of Boerhaave's chemistry, and represented fig. 1. Plate CXXXIV.

This furnace is made of earth; and, as the workmanship of a furnace requires none of the neatness or elegance which is required in making potters vessels, any person may easily make a furnace of this kind for himself, who has time and patience for so doing. With regard to the most proper materials, all that we have said concerning crucibles and retorts must be applicable to the materials for constructing a furnace; only here we need not care so much for the porosity, or disposition to crumble, as when crucibles or other distilling vessels are to be made.

Plate iron is commonly directed for the outside of portable furnaces; but we cannot help thinking this is a very needless expence, seeing the coating which it necessarily requires on the inside may be supposed to harden to such a degree as soon to support itself, without any assistance from the plate-iron. This will be the less necessary, if we consider, that, for the thickness of the walls of any furnace where a considerable heat is wanted, two or three inches are by no means sufficient. When the inside of a furnace is heated, the walls, if very thin, are soon penetrated by the heat, and great part of it by this means dissipated in the air. If they are of a sufficient thickness, the heat cannot penetrate so easily; and thus the inner part of the furnace preserves the heat of the fuel, and communicates it to the contained vessel. In the construction of a portable furnace, therefore, it will be convenient to have all parts of it six inches thick at least. This will also give it a sufficient degree of strength; and, as it is formed of several different peices, no inconvenience can follow from the weight of each of them taken separately.

In Boerhaave's chemistry, this furnace is represented as narrower at the bottom than at the top; but we cannot suppose any good reason for such a form, seeing a cylindrical one must answer every purpose much better, as allowing a larger quantity of air to pass through the fuel, and likewise not being so apt to be overturned as it necessarily must be where the upper part is considerably heavier than the lower. We have, therefore, given a representation of it as of a cylindrical form.

The furnace consists of five or more parts. C, represents the dome, or top of the furnace, with a short earthen funnel E for transmitting the smoke. B, B, B, are moveable cylinders of earth, each provided with a door D, D, D. In Boerhaave's chemistry these doors are represented as having iron hinges and latchets; but they may be formed to more advantage of square pieces of earth, having two holes in the middle, by which they may be occasionally taken out, by introducing an iron fork. In like manner, the domes and cylinders,

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cylinders, in Boerhaave's chemistry, are represented with iron handles; but they may be almost as easily taken off by the cheaper contrivance of having four holes in each, two directly opposite to one another, into which two short forks may be introduced when the parts are to be separated.

In the lowermost cylinder is to be placed an iron-grate, a little below the door, for supporting the fire. In the under part is a small hole, big enough for introducing the pipe of a pair of good perpetual bellows when the fire is to be violently excited. Dr Lewis prefers the organ-bellows to any other kind.

When the bellows is used, the whole must stand upon a close cylinder A, that the air may be confined, and made to pass through the fuel. By having more bellows, the fire may be excited to a most intense degree. In this case, the pipe of every one of them must enter the cylinder B.

Each of the cylinders should have, in its upper part a round hole, opposite to its door, for carrying off the smoke, by means of a pipe inserted into it, when the furnace is used for distillations by the sand-bath. Each cylinder ought likewise to have a semicircular cut in the opposite sides, both above and below, that when the under cut of the upper cylinder is brought directly above the upper cut of the lower one, a perfect circle may be formed. These are for giving a passage to the necks of retorts, when distillation by the retort is to be performed. The holes may be occasionally filled with stopples made of the same materials with the body of the furnace.

The most convenient situation for a furnace of this kind would be under a chimney, the vent of which might be easily stopped up by a broad plate of iron, in which a hole ought to be cut for the reception of the earthen tube of the dome. By this means the use of a long tube, which at any rate must be very troublesome, might be easily avoided, and a very strong blast of air would pass through the fuel. If it is found convenient to place the furnace at some distance from the chimney, a plate-iron pipe must be procured to fit the earthen pipe of the dome, and carry the smoke into the chimney. This pipe will also be of use, when the furnace is used for distillations by the sand-bath; it must then be inserted into the hole opposite to the door of any of the cylinders, and will convey away the smoke, while the mouth of the cylinder is totally covered with a sand-pot.

601 Dr Lewis's portable furnaces.

For portable furnaces, Dr Lewis greatly recommends the large black crucibles, marked n° 60, on account of their resisting a violent heat, and being very easily cut by a knife or saw, so that doors, &c. may be formed in them at pleasure. The bottom of one of these large ones being cut out, a grate is to be put into the narrow part of it. For grates, the doctor recommends cast iron-rings, having each three knobs around them. These knobs go into corresponding cavities of the outer rings, and the knobs of the outermost rest on the crucible, which is to be indented a little to receive them, that so the grate may rest the more firmly, and the furnace not be endangered from the swelling of the iron by heat. When this is to be made use of as a melting-furnace, and a violent heat to be excited, another crucible must be inverted on that which contains the fuel, which serves instead of the dome of the last mentioned furnace: and as whatever is said of it must likewise be applicable to the two crucibles when placed above one another, we need give no farther description of the doctor's portable furnace.

602 Objection to their use in some cases.

No doubt, the great experience of Dr Lewis, in chemical matters must give very considerable weight to any thing he advances; and the warmth with which he recommends the furnaces must convince us, that he has found them abundantly answer the purposes of experiments. We cannot help thinking, however, that where a very great and lasting heat is to be given, the thickness, and even the *form*, of these crucibles, is some objection to their use. It is certain that such a permanent, or, as the workmen call it, a *solid* heat, can never be given where the walls of a furnace are thin, as when they are of sufficient thickness. They are also very apt to burst with great heat; and, for this reason, Dr Lewis desires his furnace to be strengthened with copper hoops. This disposition to burst proceeds from the inner parts which are more intensely heated than the outer, expanding more than these do, and consequently bursting them. Hence the doctor desires his furnace to be strengthened also by putting it within another crucible of a larger size, and the intermediate space to be filled up with a mixture of sifted ashes and water. For most chemical processes, where only a small degree of heat is requisite, these furnaces answer beyond any thing that has hitherto been attempted. The whole is to be supported by an iron ring with three feet

2d 602 Dr Black's furnace described. Plate CXXXIII fig. 5, 8, 9.

Dr Black has contrived a furnace in which all these inconveniences are avoided. Two thick iron plates, above and below, are joined by a thinner plate, forming the body of the furnace, which is of an oval form. The upper part is perforated with two holes; the one A, pretty large, which is the mouth of the furnace, and which is of a circular form: the other behind it, B, of an oval form, and designed for fastening the end of the vent which is screwed down upon it. The undermost thick plate has only the large circular opening G near to the middle, but not altogether so, being nearer to one side of the ellipse than the other, where the round hole in the top is placed; so that a line passing this circular hole has a little obliquity forwards. The ash-pit C E is likewise made of a nelliptical form, and a very small matter widened; so that the bottom of the furnace is received within the ellipse. A little below, there is a border D that receives the bottom of the furnace; and except the holes of the damping-plate E, the parts are all closed by means of soft lute, upon which the body of the furnace is pressed down; by which means the joining of the two parts, and of all the different pieces, are made quite tight; for the body, fire place, ash-pit, vent, and grate, are all separable from one another. As the furnace comes from the workman, the grate is made to apply to the outside of the lower part. It consists of a ring laid on its edge, and then bars likewise laid on their edges; and from the outer ring proceed four pieces of iron, by means of which it may be screwed down; so it is kept out of the cavity of the furnace, and preserved from the extremity of the heat. Thus it lasts much longer, and indeed hardly liable to any decay; for by being exposed to the cool air, it is kept so cool, that it is

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is never hurt by the heat of the fuel. The ſides, which are made of plate iron muſt be luted within, to confine the heat, and preſerve them from its action.

603 How adapted to the various operations of chemiſtry.

To adapt this to the various operations of chemiſtry, we may obſerve, that for a melting furnace it is very convenient; we need only provide a cover for the opening above, which is made the door; and which being immediately over the grate, is convenient for introducing the ſubſtances to be acted upon, and for allowing us to look into the veſſel and take it out. This cover may be a piece of tile, or two bricks rendered flat and ſquare. Dr Black commonly uſes a kind of lid with a rim containing a quantity of lute; and to augment the heat, we may increaſe the height of the vent. It can be employed in moſt operations in the way of eſſaying; and the ſituation of the door allows us to ſee the ſubſtances very readily. It does not admit the introduction of the muffle; but can be employed in all thoſe operations where the muffle is made uſe of; and in Cornwall in England ſuch a furnace is made uſe of for eſſaying of metals. To preſerve the ſubſtance from the contact of the fuel, they cut off about a third part of the length of a brick, and then put it on one end on the middle of the grate. They chooſe their fuel of large pieces, that the air may have free paſſage through it, and open a little of the door, which occaſions a ſtream of air to flow in; and this ſtrikes upon the ſubſtance and produces the effect deſired; ſo that it may be uſed in the calcination of lead to convert it into litharge. It alſo anſwers very well in operations for producing vapour. If we deſire to employ it in diſtillations which require an intenſe heat, the earthen retort is to be ſuſpended by means of an iron ring having three branches ſtanding up from it, and which hangs down about half a foot from the hole; ſo that the bottom of the retort reſts upon the ring, and is immediately hung over the fuel: and the opening between the mouth of the furnace and retort is filled up with broken crucibles and potſherds, which are covered over with aſhes that tranſmit the heat very ſlowly; ſo it anſwers for diſtillations performed with the naked fire. Dr Black has ſometimes cauſed them be provided with a hole in the ſide, from which the neck of the retort may be made to come out; and in this way has diſtilled the phoſphorus of urine, which requires a very ſtrong heat. For diſtillations with retorts performed with the ſand-bath, there is an iron pot fitted for the opening of the furnace, which is ſet on and employed as a ſand-pot. The vent of the furnace then becomes the door; and it anſwers very well for that purpoſe; and is more eaſily kept tight than if it were in the ſide, and may be kept cloſe with a lid of charcoal and clay. In like manner it anſwers well for the common ſtill, which may be adapted to it; part of it being made to enter the open part of the furnace, and hang over the fire, as in Plate CXXXIII. fig. 8. and 9. that the bottom part of that ſtill may be made to enter; and the vent becomes the door, by which freſh fuel may be added. Indeed it is ſeldom neceſſary to add freſh fuel during any operation. In the ordinary diſtillations it is never neceſſary; and even in diſtilling mercury, phoſphorus, &c. it generally contains enough to finiſh the operation; ſo effectually is the heat preſerved from loſs or diſſipation, and ſo very ſlow is the conſumption of the fuel.

604 Luting proper for his furnace.

For luting this and other furnaces, the doctor finds nothing perferable to a ſimple mixture of ſand and clay. The proportions for ſtanding the violence of fire are four parts of ſand to one of clay; but when deſigned for the lining of furnaces, he uſes ſix or ſeven of ſand to one of clay, the more effectually to prevent the contraction of the latter; for it is known from experiments, that clay, when expoſed to a ſtrong heat, contracts the more in proportion to its purity. The ſand ſettles into leſs bulk when wet, and does not contract by heat, which it alſo reſiſts as well as the clay itſelf.

605 Method of applying the lute.

Beſides this outſide lining next the fire, Dr Black uſes another to be laid on next the iron of the furnace; and this conſiſts of clay mixed with a large portion of of charcoal duſt. It is more fit for containing the heat, and is put next to the iron, to the thickneſs of an inch and a half. That it may be pretty dry when firſt put in, he takes three parts by weight of the charcoal duſt, and one of the common clay, which muſt be mixed together when in dry powder, otherwiſe it is very difficult to mix them perfectly. As much water is added as will form the matter into balls; and theſe are beat very firm and compact by means of a hammer upon the inſide of the furnace. The other lute is then ſpread over it to the thickneſs of about half an inch, and this is alſo beat ſolid by hammering; after which it is allowed to dry ſlowly, that all cracks and fiſſures may be avoided: and after the body of the furnace is thus lined, the vent is ſcrewed on and lined in the ſame manner. It muſt then be allowed to dry for a long time; after which a fire may be kindled, and the furnace gradually heated for a day or two. The fire is then to be raiſed to the greateſt intenſity; and thus the luting acquires a hardneſs equal to that of free-ſtone, and is afterwards as laſting as any part of the furnace.

2d 605 Melting furnace.

When furnaces are uſed in the large way, they are always built of brick, and each particular operation has a furnace allotted for itſelf. The melting-furnace, where very large quantities of matter are not to be melted at once, requires only to be built of brick in ſuch a form as we have already deſcribed; only, as it would perhaps be troubleſome to procure a dome of the proper figure, the forepart of it may be left entirely open for the admiſſion of melting veſſels. The opening may be cloſed up with bricks and earth during the operation. There is no neceſſity for having the inſide of a circular form; a ſquare one will anſwer the purpoſe equally well. According to the author of the Chemical Dictionary, when the internal diameter D C of ſuch a furnace is 12 or 15 inches, the diameter of the tube G I 8 or 9 inches, and its height 18 or 20 feet, and when the ſurface is well ſupplied with fuel, and extreme heat is produced; in leſs than an hour the furnace will be white and dazzling like the ſun; its heat will be equal to the ſtrongeſt glaſs-houſe furnace; and in leſs than two hours will be melted whatever is fuſible in furnaces. The hotteſt part is at H F, 4 or 6 inches above the grate. A plate-iron tube may be advantageouſly ſupplied by a ſhort chimney of bricks, built under a pretty high vent, ſo as the whole may eaſily be ſtopped, except that paſſage which tranſmits the ſmoke of the furnace. By this means a very ſtrong current of air will be made to paſs through the fuel.

Plate CXXXIV. fig. 2.

606 Mr Pott's melting furnace deſcribed.

On this ſubject Dr Black informs us, that Mr Pott of Berlin employs one almoſt ſimilar to the above, for

for making experiments on earthen ware; by which he showed that many substances formerly rekoned infusible, might nevertheless be melted by fire raised to a very intense degree; and that several of these bodies, when mixed together, form compounds which may be melted without any difficulty. From this a tube arises to some height, and there is an additional tube which

607 Reasons for making the fire-place of a roundish form.

may be put on to the height of above 10 feet. The fire-place is narrow below, but widens towards the middle, and contracts again at top, for the sake of the vessels which are put into it, and which are wider at top than at bottom. Thus the vessel is equally heated, and there is room above for containing a quantity of fuel, which descends as fast as it is consumed. Different reasons have been assigned for this form: thus Dr Boerhaave imagines that the melting furnace should be made of a parabolic form, and Macquer, that it should be in the form of an ellipse; and that the crucible should be placed in one of the foci, where they imagined the heat would be concentrated; but it is very plain, that the materials are such as are not capable of reflecting the rays of heat in a regular manner; and even though they could do so, it would be to no purpose, because the heat and light do not come from any single point, but from a great number, striking the furnace in all possible directions, and which must consequently be reflected in directions as numerous. The furnace is made of iron lined with clay; and as it is difficult to beat out the iron into this roundish form, it may as well be made cylindrical; and it is easy to give the inside what form we please by means of a luting of clay; neither need the dome have the roundish form, but may be simply made conical. The vent should be made about two-thirds of the diameter of the furnace, or such as will give an area of about one-half the grate. A small portable furnace of this kind is very convenient for ordinary crucibles; the largest of which are only about four or five inches high; the widest part of the furnace may be beat out about 10 inches diameter; and when made of thin plate iron, and lined within, are very convenient, and may be heated at very little expence of fuel. But for heating much larger vessels, it is proper to construct them of brick, when they have pretty much the same form; only it is necessary to make them square, and round on the inside with a luting of sand and clay. The top is generally made flat, and covered over with two or three bricks; the vent goes a little backwards, and then is raised to a proper height. Where the vessel to be heated is very large, it is common to leave the front open for putting in the vessel; and then to build it up with bricks, clay, and sand; which can be easily pulled down again when the operation is over.

608 When bellows are necessary.

There are some cases in which it is necessary to have a rapidity of inflammation even beyond what this furnace can give; and in these we have recourse to bellows of various constructions, by which the air can be compressed and made to enter the fuel with great velocity. These again are sometimes wrought by water; but there is another machine which produces a greater effect, viz. the *water-blast* described by Lewis in his *Commercium Philosoph. Technicum*.

609 In what cases the eolipile may be made use of.

The eolipile too may be employed for driving air into fuel. The effect of this has been considered as a proof that air acts by its elasticity in animating fuel, as an elastic fluid vapour from the eolipile produces, the same effect. But when we contrive to send steam instead of air, the same effect is not produced; and the true manner in which this instrument increases the inflammation is by driving air through the fuel: the steam from the vessel spreading and mixing with the air, and driving it before it, makes it strike upon the fuel.



Chemists have generally believed that a wide and high ash-hole greatly increases the power of a melting furnace; but this advantage is found to be merely imaginary, as well as that of introducing the air through a long tube to the ash-hole; unless where the furnace is placed in a close room, so that it is necessary to furnish a greater blast of air than can otherwise have access.

For the form of the furnaces necessary in essaying and smelting of ores or making glass, see ESSAYING GLASS, and SMELTING. 610

Stills, sand-pots &c. how to set.

When large stills, sand-pots, &c. are to be fixed with a view to daily use, it is a matter of no small consequence to have them put up in a proper manner. The requisites here are, 1. That the whole force of the fire should be spent on the distilling vessel or sand-pot, except what is necessarily imbibed by the walls of the furnace. 2. That the vessel should be set in such a manner as that they may receive heat even from the furnace walls; for a still which contains any liquid can never be made so hot as a piece of dry brick. 3. It is absolutely necessary that the force of the fire be not allowed to collect itself upon one particular part of the vessel; otherwise that part will soon be destroyed. 3. The draught of air into furnaces of this kind ought to be moderate; only so much as will prevent smoke. If a strong blast of air enters, not only a great part of the heat will be wasted by going up the chimney, but the outside of the vessel will be calcined every time the fire is kindled, and thus must be soon rendered unfit for use.

There are few of the common workmen that are capable of building furnaces properly; and it is very necessary for a chemist to know when they are properly done, and to make the workmen act according to his directions. As the still, or whatever vessel is to be fixed, must have a support from the furnace on which it is built, it is evident the *whole* of its surface cannot be exposed to the fire. For this reason many of these vessels have had only their bottom exposed to the fire, no more space being left for the action of the heat, than the mere circular area of the still bottom; and the fire passing directly through a hole in the back part of the building, which communicated with a chimney, and consequently had a strong draught, scarce spent any of its force on the still, but went furiously up the chimney. By this means an extraordinary waste of fuel was occasioned; and that part of the still-bottom which was next the chimney receiving the whole force of the flame, was soon destroyed. Attempts were made to remedy this inconvenience, by putting the fire something forward, that it might be at greater distance from the chimney, and consequently might not spend its force in the air. This too was found to avail very little. A contrivance was then fallen upon to make the vent pass round the body of the still in a spiral form. This was a considerable improvement; but had the inconvenience of making the fire spend itself uselessly on the walls of the furnace, and besides wasted that part of the still which touched the

Chemical Furnaces. the under part of the vent. A much better method is to build the back part of the furnace entirely close, and make the fire come out through a long narrow opening before; after which it passes out through a flue in the back and upper part of the furnace into the chimney.

The only convenience of this form is, that the vent must either be very wide, or it is apt to choak up with soot, which last is a very troublesome circumstance. If the vent is made very wide, a prodigious draught of air rushes through the fuel, and increases the heat to such a degree as to calcine the metal of which the still is made; and, on the other hand, nothing can be more disagreeable than to have the vent of a furnace stopped up with soot. These inconveniences, however, are totally avoided by making two small vents, one on each side of the distilling vessel, which may communicate with a chimney by means of two tubes either of plate-iron or formed with clay or bricks, which may be occasionally taken off if they happen to be choaked up. The vessel is to be suspended by three trunnions, so that the whole surface may be exposed to the fire, excepting a ring the thickness of a brick all round; so that a very strong heat will be communicated although the furnace draws but little. The two small vents on each side will draw the flame equally; and by this means the most equable heat can be preserved, and may be pushed so far as to make the whole bottom and sides of the vessel intensely red. Such a construction as this is more especially useful for sand-pots, and those which are used for distilling alkaline spirits from bones.

In the use of the furnaces hitherto described, the attendance of the operator is necessary, both for inspecting the processes, and for supplying and animating the fuel. There are some operations, of a slower kind, that require a gentle heat to be continued for a length of time; which demand little attendance in regard to the operations themselves, and in which, of consequence, it is extremely convenient to have the attendance in regard to the fire as much as possible dispensed with. This end has been answered by the furnace called *athanor*; but the use of it has been found attended with some inconveniences, and it is now generally laid aside.

611 Lamp furnace. Sundry attempts have been made for keeping up a continued heat, with as little trouble as in the athanor, by the flame of a lamp; but the common lamp-furnaces have not answered so well as could be wished. The lamps require frequent snuffing, and smoke much; and the soot accumulated on the bottom of the vessel placed over them, is apt, at times, to fall down and put out the flame. The largeness of the wick, the irregular supply of oil from the reservoir by jets, and the oil being suffered to sink considerably in the lamp, so that the upper part of the wick burns to a coal, appeared to be the principal causes of these inconveniences; which accordingly were found to be in great measure remedied by the following construction.

Plate CXXXIV. fig. 8. The lamp consists of a brass pipe 10 or 12 inches long, and about a quarter of an inch wide, inserted at one end into the reservoir of the oil, and turned up at the other to an elbow, like the bole of a tobacco-pipe, the aperture of which is extended to the width of near two inches. On this aperture is fitted a round plate, having 5, 6, or 7 small holes, at equal distances, round its outer part, into which are inserted as many pipes about an inch long: into these pipes are drawn threads of cotten, all together not exceeding what in the common lamps form one wick: by this division of the wick, the flame exposes a larger surface to the action of the air, the fuliginous matter is consumed and carried off, and the lamp burns clear and vivid.

The reservoir is a cylindric vessel, eight or ten inches wide, composed of three parts, with a cover on the top. The middle partition communicates, by the lateral pipe, with the wicks; and has an upright open pipe soldered into its bottom, whose top reaches as high as the level of the wick; so that, when this part is charged with oil, till the oil rises up to the wicks in the other end of the lamp, any further addition of oil will run down through the upright pipe into the lower division of the reservoir. The upper division is designed for supplying oil to the middle one; and, for that purpose, is furnished with a cock in the bottom, which is turned more or less, by a key on the outside, that the oil may drop fast enough to supply the consumption, or rather faster, for the overplus is of no inconvenience, being carried off by the upright pipe; so that the oil is always, by this means, kept exactly at the same height in the lamp. For common uses, the middle division alone may be made to suffice; for, on account of its width, the sinking of the oil will not be considerable in several hours burning. In either case, however, it is expedient to renew the wicks every two or three days; oftener or seldomer according as the oil is more or less foul; for its impure matter, gradually left in the wicks, occasions the flame to become more and more dull. For the more convenient renewing of them, there should be two of the perforated plates; that when one is removed, another, with wicks fitted to it, may be ready to supply its place.

One of the black-lead pots, recommended by Dr Lewis for his portable furnace, makes a proper furnace for the lamp. If one is to be fitted up on purpose for this use, it requires no other aperture than one in the bottom for admitting air, and one in the side for the introduction of the elbow of the lamp. The reservoir stands on any convenient support without the furnace. The stopper of the side aperture consists of two pieces, that it may be conveniently put in after the lamp is introduced; and has a round hole at its bottom fitting the pipe of the lamp. By these means, the furnace being set upon a trevet or open foot, the air enters only underneath, and spreads equally all around, without coming in streams, whence the flame burns steady. It is not adviseable to attempt raising the heat higher than about the 450th degree of Fahrenheit's thermometer; a heat somewhat more than sufficient for keeping tin in perfect fusion. Some have proposed giving a much greater degree of heat in lamp-furnaces, by using a number of large wicks; but when the furnace is so heated the oil emits copious fumes, and its whole quantity takes fire. The balneum or other vessel including the subject-matters, is supported over the flame by an iron ring, as already described in the sand-bath and still: a bath is here particularly necessary, as the subject would otherwise be very unequally heated, only a small part of the vessel being exposed to the flame. Since the new invention of Argand's lamps, which perfectly consume the oil, attempts have been made to construct

Chemical Furnaces.

construct lamp-furnaces on their principles; though, on the whole, it is to be doubted whether they are preferable to the above construction or not.

*Explanations of the Plates.*

Plate CXXXIII. fig. 1. shows the figure of the still recommended by Dr Black; the bottom formed in such a manner as to go into his furnace. A, the body; B, the head; C C, the tube conveying the steam into the worm; D F, the figure of the worm; E, the worm-tub.

Fig. 2. A head taller than the common, proper for rectifying ardent spirits.

Fig. 3. Another kind of still for a common furnace, having a concave bottom for receiving the flame. A, the body; B, the head.

Fig. 4. Papin's digester. See CHEMISTRY. n° 567. A, the body; B B, the cross-bars; C D, the screw; E, the lid.

Fig. 5. The outer case of Dr Black's furnace without the luting. A, the body; B, the feet; I G, the opening at top.

Fig. 6. C, the grate of the same, with four projections, having holes in them to fasten it by nails to the inside of the furnace.

Fig. 7. A crooked funnel for putting matters into a retort without touching the sides or neck.

Fig. 8. Dr Black's furnace put together in readiness for chemical operations. A the mouth; B, the chimney; C, the door of the ash-hole. E, the registers for admitting air.

Fig. 9. A section of the same, showing its inside structure. F, the top-cover; G, the body, with part of the grate; D, the receptacle for the ashes; C, its door; E, the registers.

Fig. 10. An iron support for a crucible.

Fig. 11. The figure of a crucible.

Plate CXXXIV. fig. 1. Dr Boerhaave's portable furnace. See CHEMISTRY, n° 600.

Fig. 2. Macquer's melting-furnace. AA, the door of the ash-pit; B, the space betwixt the top of the ash-pit and fire-place; D C, the bars; G H E F, the fire-place; I, the funnel. *Ibid.* 2d n° 605.

Fig. 3. Dr Lewis's portable furnace fitted with a still, *Ibid.* n° 601, 602.

Fig. 4. Shows the figure of retorts of different kinds. A, the body; B, the neck.

Fig. 5. A matrass and alembic head, with a cucurbit and alembic head made of one piece. A, the body; B, the long neck of the matrass; C, the alembic head. A, the body of the cucurbit; B, the head; C, an opening in the head for putting in the matter to be distilled; D, a glass stopple fitted to the opening just mentioned; E, the opening of the cucurbit mouth.

Fig. 6. The pelican and cucurbit now in disuse. A, the body of the pelican; B, the head; C, an opening fitted with a stopple; D D, the arms. A, the body of the cucurbit; B, the head; C, the neck; D, the spout.

Fig. 7. A row of adopters or aludels.

Fig. 8. Dr Lewis's lamp-furnace. *Ibid.* n° 611.

# PART II. PRACTICE.

## SECT. I. *Salts.*

### § 1. *Of the* VITRIOLIC *Acid, and its Combinations.*

612 Never found pure.

THE vitriolic acid is never found pure, but always united with some proportion, either of phlogiston or metallic and earthy substances. Indeed there is scarce any kind of earth which does not contain some portion of this acid, and from which it may always some way or other be separable. When pure, the vitriolic acid appears in the form of a transparent colourless liquor. By distilling in a glass retort, the aqueous part arises, and the liquor which is left becomes

613 Rectification.

gradually more and more acid. This operation is generally called the *rectification*, or *dephlegmation*, of the acid. After the distillation has gone on for some time, the water adheres more strongly to what remains in the retort, and cannot be forced over without elevating part of the acid along with it. The remaining acid, being also exceedingly concentrated, begins to lose its fluidity, and puts on the appearance of a clear oil. This is the state in which it is usually sold, and then goes by the name of *oil of vitriol*. If the distillation is still farther continued, with a heat below 600° of Fahrenheit's thermometer, the acid gradually loses more and more of its fluidity, till at last it congeals in the cold, and becomes like ice. In this state it is called the *icy oil of vitriol*. Such exceedingly great concentration, however, is only practised on this acid for curiosity. If the heat be suddenly raised to 600°, the whole of the acid rises, and generally cracks the receiver. Clear oil of vitriol is immediately turned black by an admixture of the smallest portion of inflammable matter. 614

Attracts moisture from the air.

The icy oil of vitriol, and even that commonly sold, attracts the moisture of the air with very great force. Newmann relates, that having exposed an ounce of this acid to the air, from September 1736 to September 1737, at the end of the twelvemonth it weighed seven ounces and two drachms; and thus had attracted from the air above six times its own weight of moisture. This quantity, however, seems extraordinary; and it is probable, that in so long a time some water had been accidentally mixed with it; for Dr Gould, professor at Oxford, who seems to have tried this matter fully, relates, that three drachms of oil of vitriol acquired, in 57 days, an increase only of six drachms and an half. The acid was exposed in a glass of three inches diameter; the increase of weight the first day was upwards of one drachm; in the following days less and less, till, on the fifty-sixth, it scarce amounted to half a grain. The liquor, when saturated with humidity, retained or lost part of its acquired weight according as the atmosphere was in a moist or dry state; and this difference was so sensible as to afford an accurate hygrometer. Hoffman having exposed an ounce and two scruples in an open glass-dish, it gained seven drachms and a scruple in 14 days. 615

Productive both of cold and heat.

This acid, when mixed with a large quantity of water, makes the temperature something colder than before; but if the acid bears any considerable proportion to the water, a great heat is produced, so as to make the vessel insupportable to the hand; and therefore

Vitriolic acid and its combinations.

fore such mixtures ought very cautiously, or rather not at all, to be made in glass vessels, but in the common stone-bottles, or leaden vessels, which are not apt to be corroded by this acid. The greatest heat is produced by equal parts of acid and water.

616 Quantity of alkali saturated by it.

Though the vitriolic acid unites itself very strongly with alkalies, both fixed and volatile, it does not saturate near so much of the latter as of the former. A pound of oil of vitriol will saturate two of the common fixed alkali, but scarce one of volatile alkali. The specific gravity of good oil of vitriol is to water as 17 to 8.

617 Effects on the human body.

If the concentrated acid is applied slightly and superficially to the skin of a living animal, it raises a violent burning heat and pain; but a larger quantity pressed on, so as to prevent the ingress of aerial moisture, occasions little pain or erosion. If diluted with a little water, it proves corrosive in either case. Largely diluted with water, this acid is employed medicinally for checking putrefaction, abating heat, and quenching thirst; in debilities of the stomach, and heartburn. To persons of weak and unsound lungs, to women who give suck, to hydropic or emaciated persons, it is injurious. Some recommend it as a collyrium for sore eyes; but as it coagulates the animal juices, corroding and indurating the solids, it seems very unfit for being applied to that tender organ.

618 Difficulty of procuring it by itself.

The vitriolic acid is so much used in different arts and manufactures, that the making of it has become a trade by itself; and the procuring it in plenty, and at a cheap rate, would be a very advantageous piece of knowledge to any person who could put it in practice. This, however, is very far from being easily done; for though it exists in almost every mineral substance, the attraction betwixt this acid and the bases with which it unites, is found to be so strong, that we can only decompose such combinations by presenting another substance to the acid, to which it has a greater attraction than that one wherewith it is joined. Thus the first combination is indeed dissolved, but we have another from which it is eqally difficult to extricate the acid by itself. Thus, if we want to disengage the vitriolic acid from any metallic substance, suppose iron, this may be easily done by throwing a calcareous earth into a solution of green vitriol. We have now a compound of vitriolic acid with the calcareous earth, which is known by the name of *gypsum* or *selenites*. If we want to decompose this we must apply a volatile or or a fixed alkali; and the result of this will constantly be a new combination, which we are as unable to decompose, and indeed more so, than the first. There are two general methods which have been in use for procuring the vitriolic acid in such quantity as to supply the demands of trade. The one is from pyrites, and the other from sulphur.

### I. From *Pyrites*, with the making of Copperas, and obtaining the pure Oil of Vitriol from it.

619 Pyrites, where found.

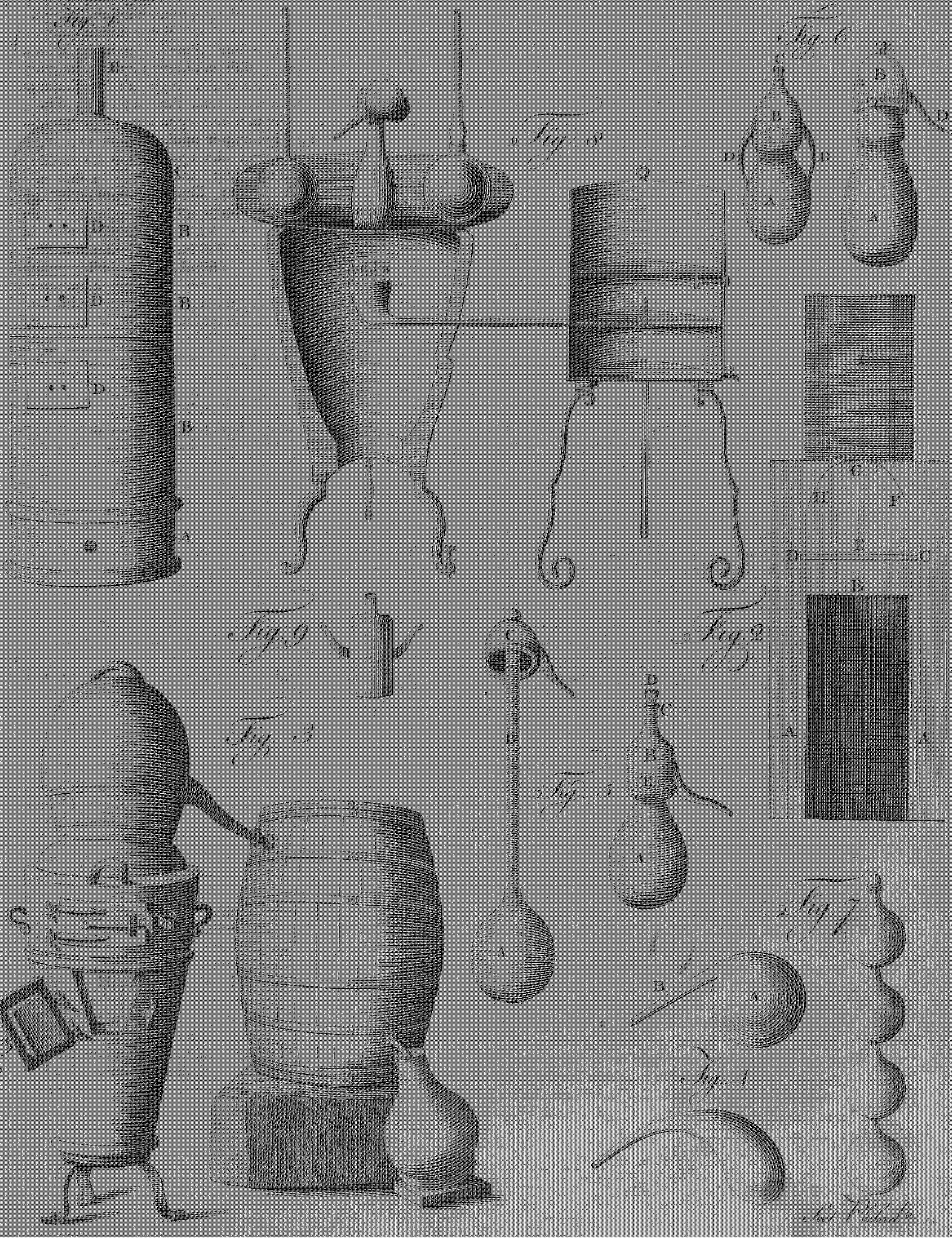
Pyrites are found in large quantity in the coal-mines of England, where most of the copperas is made. They are very hard and heavy substances, having a kind of brassy appearance, as if they contained that metal; and hence they are called *brasses* by the workmen. A very large quantity of these is collected, and spread out upon a bed of stiff clay to the depth of three feet. After being some time exposed to the air, the uppermost ones lose their metallic appearance, split, and fall to powder. The heaps are then turned, the under part uppermost, so as to expose fresh pyrites to the air. When they are all reduced to powder, which generally requires three years, the liquor, which is formed by the rain-water running from such a large mass, becomes very acid, and has likewise a styptic vitriolic taste. It is now conveyed into large cisterns lined with clay, whence it is pumped into a very large flat vessel made of lead. This vessel, which contains about 15 or 20 tons of liquor, is supported by cast-iron plates about an inch thick, between which and the lead a bed of clay is interposed. The whole rests upon narrow arches of brick, under which the fire is placed. Along with the liquor, about half a ton or more of old iron is put into the evaporating vessel. The liquor, which is very far from being saturated with acid, acts upon the iron, and, by repeated filling up as it evaporates, dissolves the whole quantity. By the time this quantity is dissolved, a pellicle is formed on the surface. The fire is then put out; and as such a prodigious quantity of liquor does not admit of filtration, it is left to settle for a whole day, and then is let off by a cock placed a little above the bottom of the evaporating vessel, so as to allow the impurities to remain behind. It is conveyed by wooden spouts to a large leaden cistern, five or six feet deep, sunk in the ground, and which is capable of containing the whole quantity of liquor. Here the copperas crystallizes on the sides, and on sticks put into the liquor. The crystallization usually takes up three weeks. The liquor is then pumped back into the evaporating vessel; more iron, and fresh liquor from the pyrites, are added; and a new solution takes place.

Copperas is used, in dyeing, for procuring a black colour; and is an ingredient in making common ink. It is also used in medicine as a corroborant, under the name of *salt of steel*; but before it is used with this intention, it is redissolved in water, and crystallized, with the addition of a little pure oil of vitriol. Whether it is at all mended by this supposed purification, either in appearance or quality, is very doubtful.

This process furnishes us first with a very impure vitriolic acid, which could not be applied to any useful purpose; afterwards with an imperfect neutral salt, called *green vitriol*, which is applicable to several purposes where the pure acid itself could not be used; but still the acid by itself is not to be had without a very troublesome operation.

620 Distillation of vitriolic acid from copperas.

Though this acid adheres very strongly to iron, it is capable of being expelled from it by fire; yet not without a very violent and long-continued one. If we attempt to distil green vitriol in a retort, it swells and boils in such a manner by the great quantity of water contained in its crystals, that the retort will almost certainly crack; and though it should not, the salt would be changed into an hard stony mass, which the fire could never sufficiently penetrate so as to extricate the acid. It must therefore be calcined previous to the distillation. This is best done in flat iron-pans, set over a moderate fire. The salt undergoes the watery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Vitriolic acid and its combinations.

tery fusion, (See FUSION); after which it becomes opaque and white. By a continuance of the fire, it becomes brown, yellow, and at last red. For the purposes of distillation, it may be taken out as soon as it has recovered its solidity.

The dry vitriol, being now reduced to powder, is to be put into an earthen retort, or rather long neck (a kind of retort where the neck issues laterally, that the vapours may have little way to ascend), which it may nearly fill. This retort must be placed in a furnace capable of giving a very strong heat, such as the melting furnace we have already described. A large receiver is to be fitted on; and a small fire made in the furnace to heat the vessels gradually. White fumes will soon come over into the receiver, which will make the upper part warm. The fire is to be kept of an equal degree of strength, till the fumes begin to disappear, and the receiver grows cool. It is then to be increased by degrees; and the acid will become gradually more and more difficult to be raised, till at last it requires an extreme red, or even white, heat. When nothing more will come over, the fire must be suffered to go out, the receiver be unluted, and its contents poured into a bottle fixed with a glass stopper. A sulphureous and suffocating fume will come from the liquor, which must be carefully avoided.

621 Preservatives of wood.

In the retort, a fine red powder will remain, which is used in painting, and is called *colcothar of vitriol*. It is useful on account of its durability; and, when mixed with tar, has been employed as a preservative of wood from rotting; but Dr Lewis prefers finely powdered pit-coal. As a preservative for masts of ships, he recommends a mixture of tar and lampblack; concerning which he relates the following anecdote.

"I have been favoured by a gentleman on board of a vessel in the East-Indies, with an account of a violent thunder-storm, by which the main-mast was greatly damaged, and whose effects on the different parts of the mast were pretty remarkable. All the parts which were greased or covered with turpentine were burst in pieces: those above, between, and below the greased parts, as also the yard-arms, the round-top or scaffolding, coated with tar and lamp-black, remained unhurt."

622 Rectification.

Oil of vitriol, when distilled in this manner, is always of a black colour, and must therefore be rectified by distillation in a glass retort. When the acid has attained a proper degree of strength, the blackness either flies off, or separates and falls to the bottom, and the liquor becomes clear. The distillation is then to be discontinued, and the clear acid which is left in the retort kept for use.

This was the first method by which the vitriolic acid was obtained; and from its being distilled from vitriol has ever since retained the name of *oil of vitriol*. Green vitriol is the only substance from which it is practicable to draw this acid by distillation; when combined with calcareous earths, or even copper (though to this last it has a weaker attraction than to iron), it resists the fire most obstinately. When distillation from vitriol was practised, large furnaces were erected for that purpose, capable of containing an hundred long necks at once: but as it has been discovered to be more easily procurable from sulphur, this method has been laid aside, and it is now needless to describe these furnaces.

### II. To procure the Vitriolic Acid from *Sulphur*.

623 Quantity of acid in sulphur.

This substance contains the vitriolic acid in such plenty, that every pound of sulphur, according to Mr Kirwan's calculation, contains more than one-half of pure acid; which being in a state perfectly dry, is consequently of a strength far beyond that of the most highly rectified oil of vitriol. Common oil of vitriol requires to be distilled to one-fourth of its quantity before it will coagulate when cold; and even in this state it undoubtedly contains some water. No method, however, has as yet been fallen upon to condense all the steams of burning sulphur, at least in the large way, nor is any other profitable way of decomposing sulphur known than that by burning; and in this way the most successful operators have never obtained more than 14 ounces of oil from a pound of sulphur.

624 Quantity produced from it.

625 Methods of obviating the difficulties in this process.

The difficulties here are, that sulphur cannnot be burnt but in an open vessel; and the stream of air, which is admitted to make it burn, also carries off the acid which is emitted in the form of smoke. To avoid this, a method was contrived of burning sulphur in large glass globes, capable of containing an hogshead or more. The fume of the burning sulphur was then allowed to circulate till it condensed into an acid liquor. A greater difficulty, however, occurs here; for though the sulphur burns very well, its steams will never condense. It has been said, that the condensation is promoted by keeping some warm water continually smoking in the bottom of the globe; and even Dr Lewis has asserted this: but the steam of warm water immediately extinguishes sulphur, as we have often experienced; neither does the fume of burning sulphur seem at all inclinable to join with water, even when forced into contact with it. As it arises from the sulphur, it contains a quantity of phlogiston, which in a great measure keeps it from uniting with water; and the desideratum is not something to make the sulphur burn freely, but to deprive the fumes of the phlogiston they contain, and render them miscible with water. For this purpose nitre has been advantageously used. This consumes a very large quantity of the phlogiston contained in sulphur, and renders the acid easily condensible: but it is plain that few of the fumes, comparatively speaking, are thus deprived of the inflammable principle; for the vessel in which the sulphur and nitre are burnt, remains filled with a volatile and most suffocating fume, which extinguishes flame, and issues in such quantity as to render it highly dangerous to stay near the place. It has been thought that nitre contributes to the burning of the sulphur in close vessels; but this too is a mistake. More sulphur may be burnt in an oil of vitriol globe without nitre than with it, as we have often experienced; for the acid of the sulphur unites with the alkaline basis of the nitre, and forms therewith an uninflammable compound, which soon extinguishes the flame, and even prevents a part of the sulphur from being burnt either at that time or any other.

626 Effervescence between the nitrous and sulphureous fumes.

In the condensation of the fumes of sulphur by means of nitre, a remarkable effervescence happens, which naturally leads us to think that the condensation is produced by some struggle between the vitriolic and nitrous

Vitriolic acid and its combinations. nitrous acids.—Dr Lewis is of opinion, that the acid thus obtained is perfectly free from an admixture of the nitrous acid: but in this he is certainly mistaken; for, on rectifying the acid produced by sulphur and nitre, the first fumes that come over are red, after which they change their colour to white. How the nitrous acid should exist in the liquor, indeed, does not appear; for this acid is totally destructible by deflagration with charcoal: but it does not follow, that because the nitrous acid is destroyed when deflagrated with charcoal, it must likewise be so if deflagrated with sulphur. Indeed it certainly is not; for the clyssus of nitre made with sulphur is very different from that made with charcoal.

The proportions of nitre to the sulphur, used in the large oil of vitriol works, are not known, every thing being kept as secret as possible by the proprietors. Dr Lewis reckons about six pounds of nitre to an hundred weight of sulphur; but from such experiments as we have made, this appears by far too little. An ounce and an half, or two ounces, may be advantageously used to a pound of sulphur. In greater proportions, nitre seems prejudicial.

627 Lead vessels, an improvement. A very great improvement in the apparatus for making oil of vitriol, lies in the using lead vessels instead of glass globes. The globes are so apt to be broken by accident, or by the action of the acid upon them, that common prudence would suggest the use of lead to those who intend to prepare any quantity of vitriolic acid, as it is known to have so little effect upon the metal. The leaden vessels, according to the best accounts we have been able to procure, are cubes of about three feet, having on one side a door about six inches wide. The mixture of sulphur and nitre is placed in the hollow of the cube, in an earthen saucer, set on a stand made of the same materials. The quantity which can be consumed at once in such a vessel is about two ounces. To prevent the remains from sticking to the saucer, it is laid on a square bit of brown paper. The sulphur being kindled, the door is to be close shut, and the whole let alone for two hours. In that time the fumes will be condensed. The door is then to be opened; and the operator must immediately retire, to escape the suffocating fumes which issue from the vessel. It will be an hour before he can safely return, and introduce another quantity of materials, which are to be treated precisely in the same manner.

Where oil of vitriol is made in large quantities, the slowness of the operation requires a great number of globes, and constant attendance day and night. Hence the making of this acid is very expensive: The apparatus for a large work usually costs L.1500. sterling.

Vitriolic Acid COMBINED,

628 Vitriolated tartar. I. *With Fixed Alkali.* Dilute a pound of oil of vitriol with ten times its quantity of water; dissolve also two pounds of fixed alkaline salt in ten pounds of water, and filter the solution. Drop the alkali into the acid as long as any effervescence arises; managing matters so that the acid may prevail. The liquor will now be a solution of the neutral salt, called *vitriolated tartar*, which may be procured in a dry form, either by exsiccation or crystallization. In case the latter method is made use of, some more alkali must be added when it is set to evaporate, for this salt crystallizes best in an alkaline liquor.

629 [630] Different methods of preparing vitriolated tartar. Other methods, besides that above described, have been recommended for preparing vitriolated tartar; particularly that of using green vitriol instead of the pure vitriolic acid. In this case the vitriol is decomposed by the fixed alkali: but as the alkali itself dissolves the calx of iron after it is precipitated, it is next to impossible to procure a pure salt by such a process; neither is there occasion to be solicitous about the preparation of this salt by itself, as the materials for it are left in greater quantity than will ever be demanded, after the distillation of spirit of nitre.

631 Uses. Vitriolated tartar is employed in medicine as a purgative; but is not at all superior to other salts which are more easily prepared in a crystalline form. It is very difficultly soluble in water, from which proceeds the difficulty of crystallizing it: for if the acid and alkali are not very much diluted, the salt will be precipitated in powder, during the time of saturation.—It is very difficult of fusion, requiring a strong red heat; but, notwithstanding its fixedness in a violent fire, it arises with the steam of boiling water in such a manner as to be almost totally dissipated along with it by strong boiling.—This salt has been used in making glass; but with little success, as the glass wherein it is an ingredient always proves very brittle and apt to crack of itself.

632 Glauber's salt. If, instead of the vegetable fixed alkali, the vitriolic acid is saturated with the fossile one called the *salt of Soda*, a kind of neutral salt will be produced, having very different properties from the vitriolated tartar. This compound is called *Glauber's salt*. It dissolves easily in water, shoots into long and beautiful crystals, which contain a large quantity of water, in consequence of which they undergo the aqueous fusion when exposed to heat. They are also more easily fusible than vitriolated tartar.—This kind of salt was formerly much recommended as a purgative, and from its manifold virtues was intitled by its inventor *sal mirabile*. It is, however, found to possess no virtue different from that of other purgative salts: and its use is, in many places, entirely superseded by a salt prepared from the *bittern*, or liquor which remains after the crystallization of sea-salt, which shall be afterwards described.

633 Glauber's secret salt ammoniac. II. *With volatile alkali.* Take any quantity of volatile alkaline spirit; that prepared with quicklime is perferable to the other, on account of its raising no effervescence. Drop into this liquor, contained in a bottle, diluted oil of vitriol, shaking the bottle after every addition. The saturation is known to be complete by the volatile smell of the alkali being entirely destroyed. When this happens, some more of the spirit must be added, that the alkali may predominate a little, because the excess will fly off during the evaporation. The liquor, on being filtered and evaporated, will shoot into fine fibrous plates like feathers. This salt, when newly prepared, has a sulphureous smell, and a penetrating pungent taste. It readily dissolves in water, and increases the coldness of the liquor; on standing for a little time, it begins to separate from the water, and

vege-

Vitriolic acid and its combinations.

vegetate, or arise in efflorescences up the sides of the glass. It easily melts in the fire; penetrates the common crucibles; and if sublimed in glass vessels, which requires a very considerable heat, it always becomes acid, however exactly the saturation was performed.

This salt has been dignified with the names of *Glauber's secret sal ammoniac*, or *philosophic sal ammoniac*, from the high opinion which some chemists have entertained of its activity upon metals: but from Mr Pott's experiments, it appears, that its effects have been greatly exaggerated. It dissolves or corrodes in some degree all those metals which oil of vitriol dissolves, but has no effect upon those on which that acid does not act by itself.

634 Properties of the salts.

Gold is not touched in the least, either by the salt in fusion, or by a solution of it: the salt added to a solution of gold in aqua-regia occasions no precipitation or change of colour. On melting the salts with inflammable matters, it forms a sulphureous compound, which dissolves gold in fusion, in the same manner as compositions of sulphur and fixed alkaline salt. Melted with silver, it corrodes it into a white clax, which partially dissolves in water: it likewise precipitates silver from its solution in aquafortis. It acts more powerfully on copper; elevates a part of the metal in sublimation, so as to acquire a bluish colour on the surface; and renders the greatest part of the residuum soluble in water. This solution appears colourless, so that it could not be supposed to hold any copper; but readily discovers that it abounds with that metal, by the blue colour it acquires on an addition of volatile alkali, and the green calx which fixed alkalies precipitate. In evaporation it becomes green without addition. Iron is corroded by this salt in fusion, and dissolved by boiling in a solution of it. Zinc dissolves more freely and more plentifully. Lead unites with it, but does not become soluble in water. Tin is corroded, and a part of the calx is soluble in boiling water. Of regulus of antimony also a small portion is made soluble. Alkalies precipitate from the solution a bluish powder. Calcined bismuth-ore treated with its equal weight of the salt, partly dissolved in water into a pale red liquor, which became green from heat, in the same manner as tinctures made from that ore by aqua-regia. The undissolved part yielded still, with frit, a blue glass. On treating manganese in the same manner, aluminous crystals were obtained: the undissolved part of the manganese gave still a violet colour to glass.

635 Gypsum.

III. *With Calcareous Earth*. This combination may be made by saturating diluted oil of vitriol with chalk in fine powder. The mixture ought to be made in a glass; the chalk must be mixed with a pretty large quantity of water, and the acid dropped into it. The glass must be well shaken after every addition, and the mixture ought rather to be over saturated with acid; because the superfluous quantity may afterwards be washed off; the *selenite*, as it is called, or *gypsum*, having very little solubility in water.

This combination of vitriolic acid with chalk or calcareous earth, is found naturally in such plenty, that it is seldom or never made, unless for experiment's sake, or by accident. Mr Pott indeed says, that he found some slight differences between the natural and artificial gypsum, but that the former had all the essential properties of the latter.

Vitriolic acid and its combinations.

The natural gypsums are found in hard, semitransparent masses, commonly called *alabaster*, or *plaster of Paris*. (See ALABASTER, GYPSUM, and PLASTER.) By exposure to a moderate heat, they become opaque, and very friable. If they are now reduced to fine powder, and mixed with water, they may be cast into moulds of any shape: they very soon harden without shrinking; and are the materials whereof the common white images are made. This property belongs likewise to the artificial gypsum, if moderately calcined.

636 Beaume's observations.

Mr Beaumé has observed, that gypsum may be dissolved in some measure by acids; but is afterwards separable by crystallization in the same state in which it was before solution, without retaining any part of the acids. This compound, if long exposed to a pretty strong heat, loses great part of its acid, and is converted into quicklime. In glass vessels it gives over no acid with the most violent fire. It may be fused by suddenly applying a very intense heat. With clay it soon melts, as we have observed when speaking of the materials for making crucibles. A like fusion takes place when pure calcareous earth is mixed with clay; but gypsum bubbles and swells much more in fusion with clay than calcareous earth.

From natural gypsum we see that vitriolated tartar may be made, in a manner similar to its preparation from green vitriol. If fixed alkaline salt is boiled with any quantity of gypsum, the earth of the latter will be precipitated, and the acid united with the alkali. If a mild volatile alkali is poured on gypsum contained in a glass, and the mixture frequently shaken, the gypsum will in like manner be decomposed, and a *philosophic* sal ammoniac will be formed. With the caustic volatile alkali, or that made with quicklime, no decomposition ensues.

637 Alum of the ancients different from ours.

IV. *With Argillaceous Earth*. The produce of this combination is the astringent salt called *alum*, much used in dyeing and other arts. It has its name from the Latin word *alumen* called στυπτηρια by the Greeks; though by these words the ancients expressed a stalactitic substance containing very little alum, and that entirely enveloped in a vitriolic matter. The alum used at present was first discovered in the oriental parts of the world; though we know not when, or on what occasion.

638 Whence the name of rock alum is derived.

One of the most ancient alum-works of which we have any account was that of *Roccho*, now Edessa, a city of Syria: and from this city was derived the appellation of *Roch-alum*; an expression so little understood by the generality, that it has been supposed to signify *rock-alum*. From this, and some works in the neighbourhood of Constantinople, as well as at Phocaea Nova, now Foya Nova, near Smyrna, the Italians were supplied till the middle of the 15th century, when they began to set up works of a similar kind in their own country.

639 Alum-works set up in Italy.

The first Italian alum-work was established about 1459 by Bartholomew Perdix, or Pernix, a Genoese merchant, who had discovered the proper matrix, or ore of alum, in the island of Ischia. Soon after the same material was discovered at Tolfa by John de Castro, who had visited the alum manufactories at Constantinople. Having

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ving observed the ilex aquilifolium to grow in the neighbourhood of the Turkish manufactories, and finding the same near Tolfa, he concluded that the materials for alum were to be found there also; and was quickly confirmed in his suspicions by the taste of the stones in the neighbourhood. These alum-works prospered exceedingly, and their success was augmented by an edict of Pope Pius II. prohibiting the use of foreign alum.

640 In Spain, England, and Sweden.

In the 16th century an alum manufactory was erected at Alamaron, in the neighbourhood of Carthagena, where it still continues. Several others were erected in Germany; and in the reign of Queen Elizabeth one was erected in England by Thomas Chaloner. The preparation of this salt was not known in Sweden till the 17th century.

641 Its component parts first discovered by Mess. Boulduc and Geoffroy.

The component principles of this salt were long unknown; but at last Messrs Boulduc and Geoffroy discovered, that it consisted of argillaceous earth supersaturated with vitriolic acid. This is confirmed by the experiments of other chemists. It is found to redden the tincture and paper of turnsole; and on taking away the superabundant acid, it loses its solubility and all the other properties of alum. Mr Morveau, indeed, will not admit of a superabundance of acid in alum, which he thinks would necessarily be separated by edulcoration and crystallization; and he is of opinion with Mr Kirwan, that the turning vegetable juices red is not any unequivocal sign of the presence of an acid. In the present case, however, we certainly know that there is a superabundance of acid, and that a certain portion of the vitriolic acid adheres to the clay less tenaciously than the remainder. If we put a piece of iron into a solution of alum, it will attract this portion of acid; and the vitriolated clay when deprived of the superfluous quantity, will fall down to the bottom in an insoluble powder.

642 Mistake of Morveau detected by Mr Kirwan.

643 Alum deprived of its superfluous acid insoluble in water.

Alum in its ordinary state contains a considerable quantity of water, and crystallizes by proper management into octohedral and perfectly transparent and colourless crystals. When exposed to a moderate fire, it melts, bubbles, and swells up; being gradually changed into a light, spongy, white mass, called *burnt alum*. This, with the addition of some vitriolic acid, may be crystallized as before. The principles it contains, therefore, are water, vitriolic acid, and argillaceous earth. The proportions may be ascertained in the following manner. 1. The water and superfluous vitriolic acid may be dissipated by evaporation, or rather distillation; and the loss of weight sustained by the salt, as well as the quantity of liquid which comes over into the receiver, shows the quantity of aqueous phlegm and unsaturated acid. 2. By combining this with as much caustic fixed alkali as is sufficient to saturate the acid which comes over, we know its proportion to the water; and by redistilling this new compound, we have the water by itself. 3. The earth may be obtained by precipitation with an alkali in its caustic state, either fixed or volatile: but this part of the process is attended with considerable difficulty; for the alkalies first absorb the superfluous acid, after which the earth combined to saturation with the acid falls to the bottom, and the digestion with the alkaline salt must be continued for a very considerable time before the acid is totally separated. By analysing alum in this manner, Mr Bergman determined the principles of alum to be 38 parts of vitriolic acid, 18 of clay, and 44 of water, to 100 of the crystallized salt.

644 Bergman's method of finding the ingredients and their proportions.

645 Difficulty in obtaining the pure earth of alum.

646 Proportions of ingredients according to Mr Bergman.

It has been a question among chemists, whether the earth of alum is to be considered as a pure clay or not. The salt was extracted from common clay by Messrs Hellot and Geoffroy. The experiment was repeated with success by Mr Pott; but he seemed to consider it rather as the production of a new substance during the operation, than a combination of any principle already existing with the vitriolic acid. Margraaf, however, from some very accurate experiments, demonstrated, that all kinds of clay consist of two principles mechanically mixed: one of which constantly is the pure earth of alum. This opinion is espoused by Bergman; who concludes, that since an equal quantity of it may be extracted from clay by all the acids, it can only be mixed with these clays; for if it was generated by the menstrua during the operation, it must be procured in different quantities, if not of different qualities also, according to the difference of the solvents made use of. Notwithstanding this, the matter seems to be rendered somewhat obscure by an experiment of Dr Lewis. "Powdered tobacco-pipe clay (says he) being boiled in a considerable quantity of oil of vitriol, and the boiling continued to dryness, the matter when cold discovers very little taste, or only a slight acidulous one. Exposed to the air for a few days, the greatest part of it was changed into lanuginous efflorescences tasting exactly like alum. The remainder, treated with fresh oil of vitriol, in the same manner exhibits the same phenomena till nearly the whole of the clay is converted into an astringent salt." Hence he concludes, that the clay is in some degree changed before the aluminous salt is produced. Without this supposition, indeed, it is difficult to see why the salt should not be produced immediately by the combination of the two principles. An hundred parts of crystallized alum requires, according to Mr Bergman, in a mean heat 1412 parts of distilled water, but in a boiling heat only 75 of the same parts for its solution. The specific gravity of alum, when computed from the increase of bulk in its solution, is 2.071 when the air-bubbles are abstracted; but if they are suffered to remain, it is no more than 1.757. These bubbles consist of aerial acid, but cannot be removed by the air-pump, though they fly off on the application of heat.

647 Whether the earth of alum be a pure clay or not.

648 Component parts of all kinds of clay investigated by Margraaf.

649 Lewis's experiment, tending to show that clay undergoes some change in being converted into earth of alum.

650 Solubility of alum in warm and in cold water.

The ores from which alum is prepared for sale, according to Mr Bergman, are of two kinds: one containing the alum already formed, the other its principles united by roasting. What he calls the aluminous schist, is nothing but an argillaceous schist impregnated with a dried petroleum, from whence the oil is easily extracted by distillation; but by applying proper menstrua it discovers several other ingredients, particularly an argillaceous martial substance, frequently amounting to $\frac{3}{4}$ of the whole; a siliceous matter amounting to $\frac{1}{6}$; and commonly also a small proportion of calcareous earth and magnesia; the rest being all pyritous. By roasting this ore the bituminous part is destroyed and the pyrites decomposed; on which part of the vitriolic acid adheres to the iron of the pyrites, and the rest to the pure clay of the schist, forming green vitriol with the former, and alum with the latter. If any calcareous earth or magnesia are present, gypsum and Epsom salt will be produced at the same time. No salt is obtained by

651 Bergman's account of the Swedish ores of alum.

652 Component parts of the aluminous schist.

653 How changed by roasting.

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by lixiviating this schist before calcination, though Mr Bergman thinks nothing more is necessary for the production of the salt but the presence of a pyrites. This, he tells us, is generally dispersed through the mass in form of very minute particles, though it sometimes appears in small nuclei. The goodness of the ore, therefore, depends on the proper proportion of the pyrites to the clay, and its equal distribution through the whole. The most dense and ponderous is most esteemed, while that which contains so much pyrites as to be visible is rejected as having too much iron. The ore which produces less than four pounds of alum from 100 of the ore does not pay the expence of manufacturing in Sweden. Sometimes this kind of ore produces salts without the application of fire; but this must be attributed to a kind of spontaneous calcination.

654 The presence of pyrites only necessary for the production of alum.

655 Ores containing alum ready formed, only to be met with in volcanic countries.

That species of ore which contains the principles already united into alum, according to Mr Bergman, is to be met with only in volcanic countries; and of this kind are the principal Italian ores of alum, particularly that employed at Tolfa near Cincelles, for boiling the Roman alum. Mr Monnet, however, is of opinion, that even this ore does not contain alum perfectly formed, but a combination of nearly equal parts of clay and sulphur, which by exposure to air during calcination, is converted into alum. He found a little martial earth also contained in it, to which he ascribes the reddish colour of that alum. The aluminous ore at Solfatara in Italy consists of old lava whitened by the phlogisticated vitriolic acid. The clay thus becomes a component part of the aluminous salt, and the mass effloresces in the same manner, and for the same reason, as the mass left after boiling tobacco-pipe clay in oil of vitriol mentioned by Dr Lewis. Mr Bergman, who examined this ore, found, that 100 pounds of it contained eight of pure alum, besides four of pure clay; and that the remainder was siliceous. This proportion, however, must be very variable, according to the quantity of rain which falls upon the ore.

656 Aluminous ore at Solfatara in Italy.

657 Analyzed by Mr Bergman

658 Aluminous ores in Hassia, Bohemia, and Scania.

A variety of aluminous ores are to be met with in different parts of the world. In Hassia and Bohemia this salt is obtained from wood impregnated with bitumen. At Helsingborg in Scania, a turf is found consisting of the roots of vegetables mixed with nuts, straw, and leaves, often covered with a thin pyritous cuticle, which, when elixated, yields alum: Even the sulphureous pyrites is generally mixed with an argillaceous matter, which may be separated by menstrua. In some places, sulphur, vitriol, and alum are extracted from the same material. The sulphur rises by distillation; the residuum is exposed to the air till it effloresces, after which a green vitriol is obtained by lixiviation, and alum from the same liquor, after no more vitriol will crystallize. The *alum slate*, from which salt is made near York in England, contains a considerable quantity of sulphur; and therefore produces alum on the principles already mentioned.

659 Alum, sulphur, and vitriol extracted from the same ore.

660 Alum slate found at York in England.

661 Bergman's directions for the preparation of alum.

Mr Bergman has given very particular directions for the preparation of this salt from its ores, and minutely describes the several operations which they must undergo. These are,

662 Use of roasting the ore.

1. Roasting. This is absolutely necessary in order to destroy the pyrites; for on this the formation of the alum entirely depends; as the sulphur of the pyrites will not part with its phlogiston without a burning heat in the open air. By long exposure to the air, indeed, the same effect will follow; but unless the ore be of a particular kind, and loose in texture, so that the air can freely pervade it, the process we speak of cannot take place. The hard ores, therefore, cannot be treated in this manner; and the earthy ores are not only unfit for spontaneous calcination, but for roasting also, as they will not allow the air to pervade them and extinguish the fire. Such as are capable of spontaneous calcination, should be supplied with some quantity of water, and laid on a hard clay bottom, as directed for making green vitriol. The roasting is performed in Sweden in the following manner. Small pieces of the ore are strewed upon a layer of burning sticks to the thickness of half a foot. When the sticks are consumed, these are covered, nearly to the same thickness, with pieces burned before and four times lixiviated: Thus strata are alternately laid of such a thickness, and at such intervals of time, that the fire may continue, and the whole mass grow hot and smoke, but not break out into flame. The upper strata may sometimes be increased to a double thickness on account of the long continuance of the fire. When eight strata are laid, another row is placed contiguous to the former; when this is finished, a third; and so on until the heap be of a proper size, which rarely requires more than three rows. When the ore is once roasted, it still contains so much phlogiston that water acts but little upon it; but after the operation is two or three times repeated, the ore yields its principles more freely: the roasting may even be repeated to advantage till the whole be reduced to powder. The bitumen keeps up the fire; for which reason alternate layers of the crude ore are used; and in rainy weather these layers of unburnt ore should be thicker. An heap, 20 feet broad at the base, two feet at the top, and consisting of 26 rows, is finished in three weeks, but requires two or three months to be well burned, and three weeks to cool. The greater pyritous nuclei explode like bombs. In this process the sulphur of the pyrites is slowly consumed, and the phlogisticated acid penetrating the mass, is fixed; after which the remaining phlogiston is gradually dissipated. The chief art consists in moderating the heat in such a manner as to avoid with safety the two extremes; for too small a fire would not be capable of forming the salt, while a heat too strong would destroy it by melting the ore. The scoria are insoluble in water, and therefore thrown away as useless. They are produced by violent winds, or by a strong heat too much closed up; for it is necessary to make holes in the red strata, that the fire may reach the back stratum which is to be laid on. Another method of burning was invented by the celebrated Rinman, and is practised at a place called *Garphyttan* in Sweden. There the ore itself is set on fire; and after burning is boiled, and yields alum in the same manner as the former. The heaps are formed in the following manner: First the schist, burning from the furnace, is laid to the depth of four feet; if the fire be slow, then wood is added; after that a thin stratum of elixated schist; the third consists of schist not burned; and the fourth of elixated schist a foot and a half thick; after that the burning schist, and so on. This method, however, is attended with some inconveniences. The vitriolic acid is partly dissipated by the fire, and thus the

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663 Exposure to the air has sometimes the same effect.

664 Earthy ores unfit for both operations.

665 Method of roasting the ore in Sweden.

666 How often the operation is to be repeated.

667 Danger of raising the heat too much.

668 Rinman's method of burning the ore at Garphyttan.

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the quantity of alum is diminiſhed: ſo much ſchiſt alſo is requiſite in this method that it cannot all be elixated; and thus the heap muſt be perpetually increaſing.

669 Method of burning the hard ores at Tolfa in Italy. The hard ores containing bitumen, ſuch as thoſe of Tolfa, are burned upon wood for ſome hours like limeſtone, until they become pervious to water, and ffloreſce. The fire is extinguiſhed as ſoon as the flame becomes white, and the ſmell of ſulphureous acid begins to be perceived. When the ore cools, thoſe particles which were neareſt to the fire are placed outermoſt, and thoſe which had been outermoſt within, the fire being again lighted. The ore is ſufficiently burned when it can be broken with the hands. It is then heaped up near certain trenches, and watered five times a-day, particularly when the ſun ſhines clear; the operation being deſtroyed by a continued rain and cloudy ſky. In ſome places the ore is firſt burned and afterwards elixated; neither is there any way of knowing the proper methods of managing it but by experiment.

670 Method of elixating the burned ore at Garphyttan with cold water. 2. Elixation. This is performed in ſome places with hot, and at others with cold, water. At Garphyttan in Sweden, where the latter method is choſen, the receptacles, in the year 1772, were of hewn ſtone, having their joints united by ſome cement capable of reſiſting the liquor. Every ſet conſiſted of four ſquare receptacles diſpoſed round a fifth, which was deeper than the reſt. The firſt receptacle is filled with roaſted ſchiſt, and the ore lies in water for 24 hours; the water is then drawn off by a pipe into the fifth; from thence into the ſecond, containing ſchiſt not yet waſhed; from that in like manner, after 24 hours, through the fifth into the third, and ſo into the fourth The lixivium is then conveyed to the fifth, and allowed to ſtand in it; and laſtly is drawn off into a veſſel appropriated for its reception.

671 Other methods. —In other places the water paſſes over the ſchiſt that has been waſhed three times for ſix hours; then that which has been twice waſhed, next what has been once waſhed, and laſtly, the ore which has been newly roaſted.

672 Singular circumſtance by which the alum may be deſtroyed. Thoſe who ſuperintend the alum manufactories are of opinion that the alum is deſtroyed by paſſing the water firſt over the newly burnt ore, and then over that which has been previouſly elixated.

673 Of the proper ſtrength of the lixivium before boiling. The lixivium, before boiling, ought to be as richly impregnated with alum as poſſible, in order to ſave fuel, though this is frequently neglected. In ſome places the taſte is uſed as the only criterion; but in others the weight of water which fills a ſmall glaſs bottle is divided into 64 equal parts, each of which is called in Sweden a *panning*; and the quantity by which the ſame bottle, full of lixivium, exceeds it when filled with water, is ſuppoſed to indicate the quantity of ſalt diſſolved.—This method may undoubtedly be reckoned ſufficiently accurate for work conducted on a large ſcale: and though Mr Bergman gives formulae by which the matter may be determined to a ſcrupulous exactneſs, it does not appear that ſuch accuracy is either neceſſary or indeed practicable in works conducted in a great way.

Thoſe who manage the alum manufactories aſſert, that the cold lixivium ought to be made no richer than when the weight of the bottle filled with lixivium exceeds it when filled with water by $4\frac{1}{2}$ pannings, which ſhows the water to be loaded with $\frac{1}{5.7}$ of its weight of alum. If the overplus amounts to ſix pannings, which indicates its containing $\frac{1}{3.4}$ of ſalt, cryſtals are then depoſited.—Congelation is of no uſe to concentrate the aluminous lixivium; for water ſaturated with alum freezes almoſt as readily as pure water.

674 Conſtruction of the evaporating veſſel. 3. Boiling the ley for chryſtallization. The ley being firſt brought from the pits through canals made for the purpoſe, is put into a leaden boiler, at the back of which is a reſervoir, out of which the loſs ſuſtained by evaporation is conſtantly ſupplied, ſo that the ſurface of that in the boiler continues always nearly at the ſame height. Various ſigns are uſed by different manufacturers to know when the ley is properly evaporated: ſome determining the matter by the floating of a new laid egg; others by dropping a ſmall quantity on a plate, and obſerving whether it cryſtallizes on cooling; and laſtly, others weigh the lixivium in the bottle abovementioned.

675 Proper ſtrength of the evaporated liquor. The boiling is ſuppoſed to be finiſhed if the increaſe of weight be equal to 10 pannings; that is, if the water be loaded with $\frac{1}{1.69}$ of its own weight. It might, however, take up above $\frac{1}{3}$ of its weight, or nearly 27 pannings; but as it has to be depurated by ſtanding quiet before the cryſtals are formed, the liquor muſt not be fully ſaturated with ſalt.

676 Of the firſt cryſtallization. The lixivium, when ſufficiently concentrated by evaporation, flows through proper channels into coolers, where it is allowed to reſt for about an hour to free it from the groſſer ſediment; after which it is put into wooden or ſtone receptacles to cryſtallize. In eight or ten days the remaining liquor, commonly called *mother ley*, or *magiſtral water*, is let off into another veſſel. A great number of cryſtals, generally ſmall and impure, adhere to the bottom and ſides of the veſſel, which are afterwards collected and waſhed in cold water.

677 Depuration of the cryſtals. When a ſufficient quantity of the ſmall cryſtals are collected, thy muſt then be put into the boiler for depuration. They are now diſſolved in as ſmall a quantity of water as poſſible; after which the lixivium is poured into a great tub containing as much as the boiler itſelf. In 61 or 81 days the hoops of the tub are looſed, and the aluminous maſs bound with an iron ring; and in 28 days more the reſiduum of the ſolution is let out through a hole, and collected in a trench; after which the ſaline maſs, which at Garphyttan in Sweden amounts to 26 tons, is dried and ſold as depurated alum. The boiler emptied for the firſt cryſtallization is next filled two-thirds full with the magiſtral lixivium; and as ſoon as the liquor arrives at the boiling point, the other third is filled with crude lixivium, with which the evaporation is alſo conſtantly ſupplied. A certain quantity of the aluminous impurities left by waſhing the ſalts of the firſt cryſtallization in water is then added, and the above deſcribed proceſs repeated. Only the firſt boiling in the ſpring is performed with the crude lixivium alone, the reſt are all done as juſt now related.

678 Bergman's remarks on the proper form of the coolers. —Mr Bergman remarks, that the time required for cryſtallization may undoubtedly be ſhortened. The reſervoirs uſed in Sweden for this purpoſe (he ſays), are deep and narrow at the top; on which account they are not only long

long in cooling, but the evaporation, which is abſolutely neceſſary for the cryſtallization, goes on very ſlowly, excepting in extremely warm weather, at the ſame time that the doors and windows are diſpoſed in ſuch a manner as to direct a current of air along the ſurface. In Italy he tells us that conical reſervoirs are uſed with the wide part uppermoſt.

679 **Alum cannot be formed by merely evaporating and cooling the ley, on account of the exceſs of acid.**

It is remarkable, that pure alum cannot be obtained in very conſiderable quantity by merely evaporating and cooling the ley. The reaſon of this is, that the lixivium ſometimes acquires ſuch a conſiſtence, that it both cryſtallizes with difficulty, and produces impure cryſtals. The cauſe was unknown till the time of Mr Bergman, who has ſhown that it proceeds from an exceſs of vitriolic acid. Hence alſo we may ſee the reaſon why alkaline ſalts, volatile alkali in its pure ſtate, or even putrefied urine, when added to this thick ſolution, produce good cryſtals of alum when they cannot be obtained otherwiſe.

680 **This exceſs cannot be removed by mineral alkali, though it may be by vegetable and volatile alkalies, and beſt of all by pure clay.**

It is remarkable that this impediment to cryſtallization is not removed by mineral alkali, though it is ſo by the vegetable and volatile alkalies, which is a phenomenon hitherto unexplained. According to our author, however, an addition of pure clay, to abſorb the ſuperabundant acid, is preferable to any other; and indeed it is reaſonable to think ſo, as the union of vitriolic acid and pure clay forms the ſalt deſired, which is not the caſe with any of the alkalies. To aſcertain this, he made the following experiments.

681 **Experiment ſhowing that an exceſs of vitriolic acid impedes the cryſtallization of alum.**

1. He diſſolved 215 grains of pure alum in diſtilled water, in a ſmall cucurbit, and evaporated it over the fire till the ſurface of the liquor ſtood at two marks, which indicated, in a former evaporation, that it was fit for cryſtallization. 2. Having poured out this into a proper glaſs veſſel, he diſſolved other 215 grains, and added to the ſolution 24$\frac{1}{4}$ grains of concentrated vitriolic acid. 3. This ſolution being likewiſe poured out, the experiment was repeated a third time, with the addition of 53 grains of vitriolic acid; and the glaſſes being at laſt ſet in a proper place for cryſtallization, the firſt yielded 155$\frac{3}{4}$, the ſecond 130, and the third 100$\frac{1}{4}$ grains of alum.

682 **Experiment to determine the uſefulneſs of adding clay to the ley.**

This ſhows that an exceſs of vitriolic acid impedes the cryſtallization of the alum; but to determine how far this could be remedied by the addition of clay, farther experiments were neceſſary. Having therefore employed a magiſtral reſiduum, in which the exceſs of acid was nearly in the proportion already related, he added two drachms of clay in fine powder to a kanne, or Swediſh cantharus, of the liquor: he boiled the mixture for ten minutes; and on ſeparating the clay that remained, he found that 25$\frac{1}{7}$ grains were diſſolved, which indicates an increaſe of 141 grains of alum. On gently boiling the liquor for half an hour, 75 grains of the clay were diſſolved, which indicated an increaſe of 416 grains of alum.

683 **Advantages of uſing clay rather than alkalies.**

The addition of clay muſt therefore be much preferable to that of alkaline ſalts, not only as the former produces a conſiderable increaſe of alum, but alſo as there is no danger of adding too much; for we have already ſhown, that when the liquor is entirely deprived of its ſuperabundant acid, the neutrallized clay is inſoluble in water. The earth itſelf, however, diſſolves ſo ſlowly, that there is not the leaſt danger of the acid being overſaturated by ſimply boiling them together.

684 **Alum generally contaminated by dephlogiſticated vitriol.**

Alum, as commonly made, though depurated by a ſecond cryſtallization, yet is almoſt always found contaminated by dephlogiſticated vitriol; whence it grows yellow, and depoſits an ochre in ſolution when old. This is equally uſeful in ſome arts with the pureſt kind, and is even ſo in dyeing where dark colours are required; but where the more lively colours are wanted, every thing vitriolic muſt be avoided.

685 **This defect remedied by the addition of pure clay.**

This is done by the addition of pure clay, which precipitates the iron, and produces an alum entirely void of any noxious or heterogeneous matter. Nor is this contrary to the laws of chemical attraction; for though iron is diſſolved by a ſolution of alum, and the earthy baſe of alum precipitated, and though in a ſolution of vitriol and alum the white earth falls firſt on an addition of alkali, and then the ochre; this happens only in conſequence of employing phlogiſticated or metallic iron, or ſuch as is but very little dephlogiſticated; for if the inflammable principle be any further diminiſhed, the attraction is thereby ſo much weakened, that the clay has a greater attraction for the vitriolic acid than the iron. The truth of this may be proved in many different ways. Thus, let a portion of alum be diſſolved in a ſolution of highly dephlogiſticated vitriol, and an alkali then added, the ochre of the vitriol will be firſt depoſited and then the clay: and provided there be a ſufficient quantity of the latter, the iron will all be precipitated; and hence we ſee that an aluminous ſolution mixed only with one of dephlogiſticated vitriol may readily be freed from it

686 **Perfect vitriol cannot be deſtroyed by clay.**

But a ſolution of alum containing perfect vitriol cannot be freed from it effectually either by clay or alkali; for the former effects no decompoſition, and the latter, although it can deſtroy the vitriol, will undoubtedly decompoſe the alum in the firſt place. As long, therefore, as the ſolution is rich in alum, in may be employed in the common manner; but when the vitriolic ſalt begins to predominate, it muſt either be cryſtallized in its proper form, or be deſtroyed in ſuch a manner as to produce alum, which may be accompliſhed in the following manner.

687 **How the phlogiſton may be abſtracted from the vitriol.**

Let the lixivium be reduced to a tenacious maſs with clay, and formed into cakes, which muſt be expoſed in an houſe to the open air. Thus the phlogiſton, which is powerfully attracted by the dephlogiſticated part of the atmoſphere, by degrees ſeparates from the iron, while the clay is taken up by its ſuperior attraction for the acid. The calcination is accelerated by fire; but it muſt be cautiouſly employed, leſt the acid ſhould be expelled.

688 **Epſom ſalt may be produced from the mother liquor.**

In the alum manufactories in Sweden, a conſiderable quantity of vitriolated magneſia, or Epſom ſalt, is mixed with the alum. Mr Bergman directs this to be ſeparated by means of an uncalcined calcareous earth, which entirely deſtroys both the alum and vitriol; falling down to the bottom with the acid in form of a ſelenitic matter. This muſt be added to the boiling liquor gradually, leſt the effervſcence ſhould cauſe the maſs to ſwell and run over the top of the veſſel. A juſt proportion deſtroys both the aluminous and vitriolic ſalt, on being properly agitated and heated; neither is there any danger of the Epſom

ſalt

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salt being decomposed in this process, the uncalcined earth being unable to separate the magnesia from the acid. Were this method followed in the Swedish manufactories, he is of opinion, that as much Epsom salt might be produced from them as would supply the consumpt of that kingdom.

689 Superfluous acid might be advantageously distilled.

With regard to the quantity of superfluous acid found in the magistral lixivium, Mr Bergman informs us, that it amounted to five ounces in one kanne; so that in a single boiler there is nearly 250 lb. But vitriol, when well dephlogisticated, retains its acid so loosely that it may easily be separated by fire. He has no doubt, therefore, that if the surface of such a lixivium were first increased in order to let the phlogiston evaporate, the liquor might afterwards be advantageously committed to distillation for the sake of its acid.

From what has been above delivered the necessity will be sufficiently apparent of not continuing the coction even with pure clay to perfect saturation of the liquor: and this is further confirmed by M. Beaumé, who relates, that having boiled four ounces of earth of alum with two ounces of the salt, in a sufficient quantity of water, the acid became saturated to such a degree with earth, that the liquor lost its aluminous taste entirely, and assumed that of hard spring water. After filtration and evaporation, only a few micaceous crystals, very difficult of solution, were formed by letting the liquor stand for some months.—Dr Sieffert informs us, that by boiling half an ounce of alum with half a drachm of slaked lime, cubical crystals of alum may be obtained.

690 Epsom salt.

V. *With Magnesia.* The earthy substance called *magnesia alba* is never found by itself, and consequently this combination cannot originally take place by art. The vitriolic acid, however, is found combined with magnesia in great plenty in the bitter liquor which remains after the crystallization of common salt; from whence the magnesia is procured by precipitating with a fixed alkali. If this liquor, which, when the common salt is extracted, appears like clean oil of vitriol, is set by for some time in a leaden vessel, a large quantity of salt shoots, very much resembling Glauber's sal mirabile. This salt is in many places sold instead of the true Glauber's salt; and is preferred to it, because the true sal mirabile calcines in dry air, which the spurious kind does not. If after the first crystallization of the bittern, the remainder is gently evaporated farther, a fresh quantity of Glauber's salt will shoot; and if the liquor is then hastily evaporated, a salt will still be crystallized; but instead of large regular crystals, it will concrete into very small ones, having something of the appearance of snow when taken out of the liquid. These salts are essentially the same, and are all used in medicine as purgatives. The salt shot into small crystals is termed *Epsom salt*, from its being first produced from the purging waters at Epsom in England. The bittern affording this kind of salt in such great plenty, these waters were soon neglected, as they yielded it but very sparingly, and the quantity prepared from them was insufficient for the demand. Neumann says, that having inspissated 100 quarts of Epsom water, he scarce obtained half an ounce of saline matter.—According to Mr Scheele's experiments, if a solution of Epsom and common salt be mixed together, a double decomposition ensues, and the mixture contains Glauber's salt and a combination of magnesia with marine acid. From this lixivium the Glauber's salt may be crystallized in winter, but not in summer; a great degree of cold being necessary for this purpose. From twelve pounds of Epsom salt and six of common salt, Mr Scheele obtained, in a temperature three degrees below the freezing point, six pounds of Glauber salt; but in a degree of cold considerably greater, the produce was seven pounds and three quarters.

691 With silver.

VI. *With Silver.* Oil of vitriol boiled on half its weight of silver-filings, corrodes them into a saline mass. This substance is not used in medicine nor in the arts. The only remarkable property of it is, that it has a very strong attraction for mercury; coagulating and hardening as much quicksilver as the acid weighed at first. If the hard concrete be diluted with fresh acid, it melts easily in the fire, and does not part with the mercury in the greatest heat that glass vessels can sustain. The vitriolic acid, by itself, strongly retains mercury, but not near so much as when combined with silver.

Silver thus corroded by the vitriolic acid, or precipitated by it from the nitrous, may in great part be dissolved, by cautiously applying a very little water at a time; and more effectually by boiling in fresh oil of vitriol.

692 Copper.

VII. *With Copper.* With this metal the vitriolic acid cannot be combined, unless in its concentrated state, and strongly heated. If pure oil of vitriol is boiled on copper filings, or small pieces of the metal, it dissolves it into a liquor of a deep blue colour, which easily crystallizes. The crystals are of a beautiful blue colour, and are sold under the name of *blue vitriol*, or *Roman vitriol*.

693 Blue vitriol, how made.

Where sulphur is found in great plenty, however, Roman vitriol is made by stratifying thin plates of copper with sulphur; and upon slowly burning the sulphur, its acid corrodes the copper. The metal is then to be boiled in water, that the saline part may be dissolved. The operation is to be repeated till all the copper is consumed; and all the saline liquors are to be evaporated together to the crystallizing point. By this method, however, a great part of the acid is lost; and in Britain, where the sulphur must be imported, we should think the pure acid preferable for those who prepare blue vitriol.

694 Phenomena on distillation.

This salt, on being exposed to the fire, first turns white, then of a yellowish red colour. On urging it with a strong fire, the acid slowly exhales, and a dark red calx of copper remains. The whole of the vitriolic acid cannot be expelled from copper by heat: as much of it still remains as to render a part of the metal soluble in water. After this soluble part has been extracted, a little acid is still retained amounting to about $\frac{1}{14}$ of the calx.

695 Uses.

Vitriol of copper is employed in medicine as a caustic, in which respect it is very useful; but when used internally, is dangerous, as indeed all the preparations of copper are found to be. It has, nevertheless, according

Vitriolic acid and its combinations. cording to Neumann, been recommended in all kinds of intermittents, and the lepra. The smallest portion, he says, occasions a sickness and nausea; a somewhat larger, reaching and violent vomitings, accompanied often with convulsions. If the quantity taken has been considerable, and is not soon discharged by vomiting, the stomach and intestines are corroded, intense pains, inflammations, and death, succeed.

696 Iron. VIII. *With Iron.* The vitriolic acid does not act upon this metal till considerably diluted. Common oil of vitriol requires to be mixed with ten or twelve times its quantity of water before it will act briskly on the metal. In this state it effervesces violently with iron filings, or small bits of the metal, and a great quantity of inflammable vapour is discharged (see AIR). The liquor assumes a fine green colour; and by evaporation and slow coolings, very beautiful rhomboidal crystals

697 Salt of Steel are formed. These are named *salt of steel*, and are used in medicine; but for the salt made of the pure acid and iron, the common copperas, made with the impure acid extracted from pyrites, is commonly substituted. This is generally esteemed a venial fraud, and no doubt is so in medicinal respects; but when it is considered, that, by this substitution, common copperas is imposed on the ignorant, at the price of 2 *s per* pound, the affair appears in a different light.

698 Precipitation of iron from the vitriolic acid. Pure vitriol of iron is originally of a much more beautiful appearance than common copperas, and retains its colour much better; the reason of which is, that the salt thus prepared has more phlogiston than the copperas. If either of the kinds, however, are exposed to the air for a sufficient length of time, part of the acid is dissipated, and the vitriol becomes yellowish or brownish. If the salt is now dissolved in water, a brown precipitate falls, which is part of the iron in a calcined state. If the liquor is separated from this precipitate by filtration, a similar one forms in a short time, and by long standing a considerable quantity subsides. According to Dr Lewis, the precipitation is greatly expedited by a boiling heat; by which more of the metal separates in a few minutes than by standing without heat for a twelvemonth. This change takes place in no other metallic solutions.

699 Yellow for house painting. The calx of iron, precipitated by quicklime from green vitriol, appears, when dry of a yellow colour; and it is recommended in the Swedish transactions, instead of yellow ochre, as a colour for house-painting.

700 Preservative for wood. Solutions of green vitriol are also recommended for preserving wood, particularly the wheels of carriages, from decay. When all the pieces are fit for being joined together, they are directed to be boiled in a solution of vitriol for three or four hours; and then kept in a warm place for some days to dry. By this preparation, it is said, wood becomes so hard, that moisture cannot penetrate it; and that iron nails are not so apt to rust in this vitriolated wood as might be expected, but last as long as the wood itself.

701. Tin. IX. *With Tin.* This metal cannot be dissolved in the vitriolic acid, but in the same manner as silver; namely, by boiling concentrated oil of vitriol to dryness upon filings of the metal. The saline mass may then be dissolved in water, and the solution will crystallize. The salt, however, formed by this union, is not applied to any useful purpose. A salt of tin, indeed, formed by the union of vitriolic acid with this metal, has been recommended for some medical purposes, and processes are given for it in the dispensatories; but they have never come much into practice. Vitriolic acid and its combinations.

X. *With Lead.* While lead is in its metallic state, the vitriolic acid acts very little upon it, either in a diluted or concentrated state; but if the metal is dissolved in any other acid, and oil of vitriol added, a precipitation immediately ensues, which is occasioned by the combination of vitriolic acid with the lead. This precipitate will be more or less white as the metal is more or less deprived of its phlogiston by calcination before solution. If a little strong spirit of nitre is poured upon *litharge*, which is lead calcined to the greatest degree possible without vitrification, the acid unites itself to the metal with considerable effervescence and heat. Some water being now poured on, and the phial containing the mixture shaken, a turbid solution of the litharge is made. If a little oil of vitriol is then added, it throws down a beautifully white precipitate; and the acid of nitre, being left at liberty to act upon the remaining part of the litharge, begins anew to dissolve it with effervescence. When it is again saturated, more oil of vitriol is to be dropped in, and a white precipitate is again thrown down. If any of the litharge is still undissolved, the nitrous acid, being set at liberty a second time, attacks it as at first; and by continuing to add oil of vitriol, the whole of the litharge may be converted into a most beautiful and durable white. Unfortunately this colour cannot be used in oil, though in water it seems superior to any. If the process is well managed, an ounce of spirit of nitre may be made to convert several pounds of litharge into a white of this kind. 702 Lead. 703 A beautiful white colour.

XI. *With Quicksilver.* The dissolution of quicksilver in vitriolic acid cannot be performed but by a concentrated oil and strong boiling heat. The metal is first corroded into a white calx, which may afterwards be easily dissolved by an addition of fresh acid. Every time it is dissolved, the mercury becomes more and more fixed and more difficult to dry. If the exsiccation and dissolution has been repeated several times, the matter becomes at last so fixed as to bear a degree of red heat. This combination is the basis of a medicine formerly of some repute, under the name of *turbith mineral.* The process for making turbith mineral is given by the author of the Chemical Dictionary as follows. 704 Quicksilver.

"Some mercury is poured into a glass retort, and upon it an equal quantity of concentrated oil of vitriol, or more, according to the strength of the acid. These matters are to be distilled together, in the heat of a sand-bath, till nothing remains in the retort but a dry saline mass, which is a combination of the vitriolic acid and mercury. The acid which passes into the receiver is very suffocating and sulphureous; which qualities it receives from the phlogiston of the mercury. The white saline mass which is left at the bottom of the retort is to be put into a large vessel; and upon it are to be poured large quantities of hot water at several different times. The water weakens the acid, and takes it from the mercury; which is then precipitated towards the bottom of the vessel, in form of a very shining yellow powder. The water with 705 Turbith mineral.

Vitriolic acid and its combinations.

which it is washed contains the acid that was united with the mercury, and likewise a little mercury rendered soluble by means of the very large quantity of acid

Most chemists have believed, that a portion of vitriolic acid remains united with the turbith mineral, only too little to render it soluble in water. But Mr Beaumé, having examined this matter, affirms, that turbith mineral contains no acid, when it has been sufficiently washed; and that, by frequently boiling this preparation in a large quantity of distilled water, not a vestige of acid will adhere to it."

706 Dr Lewis's directions.

Dr Lewis, who is of opinion that the whole of this mercurial calx is soluble in a very large quantity of water, desires the water with which it is washed to be impregnated with some alkaline salt; which makes the yield of turbith greater than when pure water is used. The author of the Chemical Dictionary also observes, that the precipitate remains white till well freed from the acid; and the more perfectly it is washed, the deeper yellow colour it acquires.

707 Zinc.

XII. *With Zinc.* This semimetal is not acted upon by the vitriolic acid in its concentrated state; but, when diluted, is dissolved by it with effervescence, and with the extrication of an inflammable vapour in the same manner as iron. Neumann observes, that, during the dissolution, a grey and blackish spongy matter fell to the bottom; but, on standing for some days, was taken up, and dissolved in the liquor, nothing being left but a little yellowish dust scarcely worth mentioning. Six parts of oil of vitriol, diluted with an equal quantity of water, dissolves one part of zinc.

708 White vitriol.

The product of this combination is *white vitriol;* which is used in medicine as an ophthalmic, and in painting for making oil-colours dry quickly: what is used for this purpose, however, is not made in Britain, but comes from Germany. It is made at Goslar by the following process. An ore containing lead and silver, having been previously roasted for the obtaining of suphur (see METALLURGY), is lixiviated with water, and afterwards evaporated in leaden boilers, as for the preparation of green vitriol: but here a regular crystallization is prevented; for when the salt has assumed any kind of crystalline form, these crystals are made to undergo the watery fusion in copper caldrons. It is then kept constantly stirring till a considerable part of the moisture is evaporated, and the matter has acquired the consistence of fine sugar. White vitriol generally contains some ferruginous matter, from which it may be entirely freed by some fresh zinc; for this semimetal precipitates from the vitriolic acid all other metallic substances; but notwithstanding this strong attraction, the vitriolic acid is more easily expelled by distillation from white than green or blue vitriol. Towards the end of the distillation of white vitriol, the acid arises exceedingly concentrated, though sulphureous: so that, if mixed with common oil of vitriol, it will heat it almost as much as oil of vitriol heats water.

709 Regulus of antimony.

XIII. *With Regulus of Antimony.* To combine vitriolic acid with regulus of antimony, the same method must be used as directed for uniting it with quicksilver, for making turbith mineral, *viz.* to employ a very concentrated acid, and to distil in close vessels. The same phenomena also occur in this case as in making turbith mineral; a very suffocating sulphureous acid arises; and as Mr Geoffroy observes, a true sulphur sublimes into the neck of the retort; a white, saline, tumefied, mass remains in the vessel; and when the vessels are unluted, a white fume issues, as in the smoking spirit of libavius. See *Combinations of marine acid with tin,* infra.

710 Regulus of cobalt.

XIV. *With Regulus of Cobalt.* From a combination of the vitriolic acid with cobalt, a red salt may be obtained. To procure it, one part of cobalt, reduced to a very fine powder, may be mixed with two or three of concentrated acid, diluting the liquor after it has been digested for 24 hours, and then filtering and evaporating it.

711 Arsenic.

XV. *With arsenic.* Neumann relates, that powdered white arsenic being distilled in a retort with oil of vitriol, a transparent sublimate like glass arose, which in a few days lost its transparency, and became opaque like the arsenic itself. The arsenic remaining in the retort sustained an open fire without any sensible alteration. The author of the Chemical Dictionary says, that if a concentrated vitriolic acid is distilled from arsenic, the acid which comes over smells exactly like marine acid. When the solution is distilled till no more acid arises, the retort is then almost red-hot, and no arsenic is sublimed; but remains fused at the bottom of the retort; and, when cold, is found to be an heavy, compact mass, brittle and transparent as crystal-glass. This kind of arsenical glass, exposed to the air, soon loses its transparency from the moisture it attracts, which dissolves and partly deliquiates it. This deliquium is extremely acid—By digesting one part of arsenic with two of concentrated oil of vitriol, diluting the solution with water, and then filtering and evaporating, we obtain a yellowish salt which shoots into pyramidal, transparent, and shining crystals. None of the three last mentioned combinations have been found applicable to any useful purpose.

712 Oil.

XVI. *With Oil.* The product of this combination is a thick black substance, very much resembling balsam of sulphur in colour and consistence; to which it is sometimes substituted. If this substance is distilled with a gentle heat, great part of the acid becomes volatile, and evaporates in white fumes, having a pungent smell resembling that of burning sulphur. This goes by the name of *volatile* or *sulphureous vitriolic acid*; and a salt was formerly prepared from it by saturation with fixed alkali, which was thought to possess great virtues. From its inventor it was called the *sulphureous salt of Stahl.* The most singular property of this volatile acid is, that though the vitriolic in its fixed state is capable of expelling any other acid from its basis, the volatile one is expelled by every acid, even that of vinegar. It is very difficultly condensible, as we have already taken notice; and, when mixed with water, seems scarcely at all acid, but rather to have a bitterish taste.

713 Volatile sulphureous acid.

714 How procured by Dr Priestley.

Several methods have been proposed for procuring this acid from burning sulphur, which yields it in its greatest degree of volatility, as well as concentration; but the produce is so exceedingly small, that none of them are worth mentioning. Dr Priestley has given very good directions for obtaining the volatile vitriolic acid in the form of air. His method was, to pour, on some

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some oil of vitriol contained in a phial, a very small quantity of oil olive; as much as was sufficient to cover it. He then applied the proper apparatus for the reception of air in quicksilver (see AIR); and, holding a candle to the phial, the volatile vitriolic acid rushed out in great quantity. Had he received this air in water, instead of quicksilver, the consequence would have been, that some part of it, at least, would have been absorbed by the water, and a sulphureous acid liquor produced. This seems indeed almost the only method of procuring the sulphureous vitriolic acid of any tolerable strength; but it is never required in the form of a liquor, except for experimental purposes. The only useful property hitherto discovered about this kind of acid is, that it is remarkably destructive of colours of all kinds; and hence the fumes of sulphur are employed to whiten wool, &c.

715 Charcoal.

XVII. *With Phlogiston of charcoal.* If charcoal is mixed with concentrated vitriolic acid, and the mixture distilled, the same kind of acid is at first obtained, which comes over when oil is used; and towards the end, when the matter begins to grow dry, a true sulphur sublimes. The best way, however, of producing sulphur from the vitriolic acid is by combining it, when in a perfectly dry state, with the phlogiston. By this means sulphur may very readily be made at any time. The process is generally directed to be performed in the following manner.

716 Sulphur prepared from vitriolated tartar.

Reduce to fine powder any quantity of vitriolated tartar. Mingle it carefully with a 16th part of its weight of charcoal-dust. Put the whole into a covered crucible set in a melting furnace. Give a heat sufficient to melt the salt; and when thoroughly melted, pour it out on a flat stone. The vitriolated tartar and charcoal will now be converted into a sulphureous mass, similar to a combination of alkaline salts with sulphur. See *Alkaline Salts*, below.

717 Spirit of wine.

XVIII. *With Spirit of wine.* The result of this combination is one of the most extraordinary phenomena in chemistry; being that fluid, which, for its extreme degree of volatility, was first distinguished by the name of *ether:* and now, since a liquor of the like kind is discovered to be preparable from spirit of wine by means of other acids, this species is distinguished by the name of *vitriolic ether.* The method of preparing this subtle liquor recommended by M. Beaumé, seems to be the best of any hitherto discovered.

718 Ether.

Mix together equal parts by weight, of highly rectified spirit of wine and concentrated oil of vitriol, or somewhat more than two measures of spirit of wine with one of the acid. The mixture is to be made in a flint glass retort, the bottom and sides of which are very thin, that it may not break from the heat which is suddenly generated by the union of these two substances. The spirit of wine is first put into the retort, and then the acid is poured in by a glass-funnel, so that the stream may be directed against the side of the glass; in which case it will not exert much of its force on the spirit, but will lie quietly below at the bottom. The retort is now to be very gently shaken, that the acid may mingle with it by little and little. When the mixture is completed, very little more heat will be necessary to make the liquor boil.

This mixture is to be distilled with as brisk and quick a heat as possible; for which reason, immediately after the acid and spirit are mixed, the retort should be put into a sand furnace heated as much as the mixture is. The distillation should be continued only till about one-third of the liquor is come over; if it is continued farther, part of the vitriolic acid rises in a sulphureous state. In the retort a thick, black, acid matter remains, which is similar to a combination of oil of vitriol with any inflammable matter, and from which a little sulphur may be obtained. Along with the sulphureous acid, a greenish oil, called *oleum vitrioli dulcis,* arises, which has a smell compounded of that of the ether and sulphureous acid: and Mr Beaumé has shown that it is compounded of these two; for if it is rectified with an alkali, to attract the acid, it is changed into ether. If, after the distillation of the ether, some water be poured into the retort, the liquor by distillation may be brought back to the state of a pure vitriolic acid.

As the steams of the ethereal liquor are exceedingly volatile, and at the same time a quick fire is necessary to the success of the operation, the receiver must be carefully kept cool with very cold water or with snow. Care must also be taken to prevent any of the sulphureous acid steams from coming over; but as it is impossible to prevent this totally, the liquor requires rectification. This is the more necessary, as a part of the spirit of wine always rises unchanged. From this acid the liquor is easily set free, by adding a small quantity of alkaline salt, and re-distilling with a very gentle heat; but as spirit of wine is likewise very volatile, the distillation must be performed in a very tall glass. Dr Black recommends a matrass, or bolt-head, with a tin-pipe adapted to the head, so as to convey the steams at a right angle, to be condensed in the receiver. When this fluid is to be prepared in great quantities, the ether, by proper management, may be made to equal half the weight of the spirit of wine employed. Mr Dollfuss has made many important experiments on this subject; of which the following is an abstract: 1. Two pounds of vitriolic acid were mixed with as much of spirit of wine, and the mixture distilled with a very gentle fire. The first ten ounces that came over consisted of a liquor strongly impregnated with ether, and of an agreeable odour. This was put by itself and marked A. It was followed by a stronger ethereal liquor, of which a small quantity only would mix with water. Of this there were 12 ounces, which were also put by themselves, and marked B. By continuing the process two ounces more were obtained, which smelled of sulphur, and were marked C. The distillation was now continued with a view to concentrate the vitriolic acid, when three drachms of a thicker kind of ether were found swimming on a weak sulphureous acid. This thick liquid was not in the least volatile, and in consistence resembled an expressed oil. 2. Twenty-four ounces of spirit of wine were now added to the residuum of the former distillation, and the process recommenced. The first seven ounces that came over were poured to the dulcified spirit marked A. Next passed over ten ounces of a tolerably pure ether, which was mixed with the contents of B; besides two ounces that had a sulphureous smell, which were mixed with C. By a repeated dephlegmation of what remained in the retort were obtained five ounces of a weak sulphureous acid; and

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the remainder being again mixed with 20 ounces of ſpirit of wine, yielded firſt ſix ounces of the liquor marked A; then four ounces of pure ether put into that marked B; and after that another ounce marked C. By continuing the diſtillation four ounces of weak ſulphureous acid were obtained, on which floated a little oil of wine. 3. The remainder, which was very thick, and covered with a ſlight pellicle, was mixed with 20 ounces of ſpirit of wine, and yielded five ounces of dulcified ſpirit marked A; eight ounces of pure ether marked B; and at laſt one ounce of the ſame, which had rather a ſulphureous ſmell. This was followed by a few drops of acid; but the remainder frothed up with ſuch violence, that an end was put to the operation, in order to prevent its paſſing over into the receiver.

By theſe four diſtillations there were obtained from ſix pounds of ſpirit of wine and two of oil of vitriol, 28 ounces of dulcified ſpirit of vitriol and 38 of ether; which laſt, when rectified by diſtillation over manganeſe, yielded 28 ounces of the beſt ether. At the end of this diſtillation were produced 13 ounces of weak acetous acid; and the liquor of the laſt running marked C, afforded, by rectification, four ounces of good ether. The ſulphureous acid liquor yielded four ounces of weak acetous acid, and three drachms of naphtha reſembling a diſtilled oil in conſiſtence.

By theſe proceſſes the vitriolic acid was rendered quite thick and black; its weight being reduced to 24 ounces. The blackneſs was found to be owing to a powder which floated in the liquid, and could neither be ſeparated by ſubſiding to the bottom nor riſing to the top. The liquor was therefore diluted with eight ounces of water, and filtered through powdered glaſs; by which means the black ſubſtance was collected, partly in powder, and partly in grains of different ſizes. It felt very ſoft between the fingers, and left a ſtain upon paper like Indian ink; but though waſhed with 24 ounces of water, ſtill taſted acid. Half an ounce of it diſtilled in a retort yielded a drachm and an half of weak acetous mixed with a little ſulphureous acid; the reſiduum was a black coal, which by calcination in an open fire for a quarter of an hour, yielded 25 grains of white aſhes, conſiſting of ſelenite, calcareous earth, and magneſia. A drachm of it digeſted with nitrous acid, which was afterwards diſtilled from it, and then diluted with diſtilled water and filtered, yielded a few cryſtals, which appeared to be genuine ſalt of tartar, an inſoluble ſelenite being left behind. On rectifying the vitriolic acid freed from the black matter and diluted with eight ounces of water, nine ounces of ſulphureous acid were firſt obtained, after which followed an ounce of acid rather high-coloured, and then the vitriolic acid quite colourleſs. It now weighed only $19\frac{3}{4}$ ounces, and its ſpecific gravity was but 1.723, while that of the acid originally employed had been 1.989.

On repeating the proceſs with ſix pounds of ſpirit of wine to two of oil of vitriol, the firſt 12 ounces that came over were ſpirit of wine almoſt totally unchanged; then two ounces ſmelling a little of ether; and afterwards two pounds, of which about one-third were ether. When about five pounds had been drawn off, the diſtilling liquor began to ſmell ſulphureous; and after nine ounces more had been drawn off, the frothing up of the matter in the retort obliged him to put an end to the operation. The acid was then filtered through pounded glaſs as before, and afterwards committed to diſtillation. The three firſt ounces were a weak ſulphureous acid; then followed an ounce more concentrated, and of a red colour; then another of a yellowiſh caſt; after which the reſt of the acid came over quite colourleſs. The whole weighed 27 ounces, and the ſpecific gravity of it compared with diſtilled water was as 1.667 to 1.000.

719 Properties of ether.

Ether is the lighteſt of all known fluids, except air; and is ſo volatile, that *in vacuo* its boiling point is 20° below 0° of Fahrenheit's thermometer. If a ſmall quantity is poured out on the ground, it inſtantly evaporates, diffuſing its fragrance all through the room, and ſcarce perceptibly moiſtening the place on which it fell. It difficultly mixes with water, as being of an oily nature: ten parts of water, however, will take up one part of ether. Its great volatility renders it ſerviceable in nervous diſeaſes, and removing pains, when rubbed on with the hand, and kept from evaporating immediately. By ſpontaneous evaporation, it produces a great degree of cold. (See EVAPORATION and CONGELATION). The moſt extraordinary property, however, is, that if gold is diſſolved in aqua-regia) ſee *Metallic Subſtances*, below), and ether added to the ſolution, the gold will leave the acid and permanently unite with the ether. The exceeding great volatility of ether renders it very eaſily inflammable even on the approach of flame; and therefore it ought never to be diſtilled, or even poured from one veſſel to another, by candle-light. If a leſs quantity of the vitriolic acid is added to the ſpirit of wine than what is ſufficient to produce ether, the product is called *ſpiritus vitrioli dulcis*. The following experiment made by Wallerius, induced him and others to think, that the vitriolic acid was convertible into the nitrous.

720 Experiment in favour of the tranſmutation of vitriolic into nitrous acid.

"Some ſalt of tartar (ſays he) being mixed with the dulcified ſpirit of vitriol, or perhaps with the ether (for the author expreſſes himſelf a little ambiguouſly), the full bottle ſtopt with a cork, tied over with bladder, and laid on its ſide; on ſtanding for four months, the greateſt part of the ſpirit was found to have eſcaped, and the ſalt was ſhot into hexangular priſmatic cryſtals reſembling nitre. It taſted ſtrongly of the ſpirit, but had no other particular taſte. Laid on a burning coal, it crackled, exploded with a bright flaſh, and flew into the air. He afterwards found, that by adding to the ſpirit a drop or two of any acid, the ſalt cryſtallizes the ſooner; that in this caſe it has a ſouriſh taſte, but in other reſpects is the ſame with that made without acid. This ſalt-petre (ſays the author) promiſes, from the violence of its exploſion, to make the ſtrongeſt gun-powder in the world, but a very dear one. Though the experiment ſhould not be applicable to any uſe in this way, it will probably contribute to illuſtrate the generation of nitre: as it palpably ſhows nitre, that is, the acid or characteriſtic part of nitre, produced from the vitriolic acid and phlogiſton.

721 Not concluſive.

We cannot here help again regretting that chemiſts of ſuperior abilities ſhould ſometimes leave very important diſcoveries only half finiſhed, ſo that chemiſts of an inferior rank know not what to make of them. Had Wallerius,

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Wallerius, who seems more than once to have been in possession of this salt, only poured on it a few drops of oil of vitriol, the peculiar colour and smell of its fumes must have been a much more convincing proof of the reality of the transmutation than that of mere deflagration; because the latter can be otherwise accounted for.

722
Violent explosions from the application of heat.

It is certain, that many substances, water itself not excepted, will explode with great violence if suddenly heated beyond what they are able to bear. If spirit of wine is confined in a close vessel, it will also by means of heat burst it as effectually as water; and as the vapours of this substance are inflammable, the explosion will be attended with a flash if any flame is near. In like manner ether, on the approach of a candle, takes fire, and goes off in a flash like lightning; but this happens, not from any thing nitrous, but from its great volatility and inflammability. If therefore the vapours of the ethereal liquors are confined, and heat is applied suddenly to the containing vessel, their great volatility will cause them make an instantaneous effort against the sides of it, which increasing with a swiftness far beyond that of aqueous or spirituous vapours, will make a much quicker as well as a much stronger explosion than either of them; and if a flaming substance is near, the explosion will be attended with a bright flash like that of the ether itself.

In the experiment now before us, the salt tasted strongly of the spirit, or ether, from which it was made. The spirit was therefore confined in the crystals of salt; and this volatile liquor, which, even under the pressure of the atmosphere, boils with the heat of 100° of Fahrenheit, was, in a confined state, subjected to the heat of a burning coal; that is, to more than ten times the degree of heat necessary to convert it into vapour. The consequence of this could be no other, than that the particles of salt, or perhaps the air itself, not being capable of giving way soon enough to the forcible expansion of the ether, a violent explosion would happpen, and the salt be thrown about; which accordingly came to pass, and might very reasonably be expected, without any thing nitrous contained in the salt.

2d 722
Cavallo's method of purifying ether.

Mr Cavallo describes an easy and expeditious method of purifying ether, though a very expensive one; as out of a pound of the common kind scarce three or four ounces will remain of that which is purified. The method of purifying it, he says, was communicated to him by Mr Winch chemist in London, and is to be performed in the following manner. "Fill about a quarter of a strong bottle with common ether, and pour upon it twice as much water; then stop the bottle and give it a shake, so as to mix the ether for some time with the water. This done, keep the bottle for some time without motion, and the mouth of it downwards, till the ether be separated from the water, and swims above it; which it will do in three or four minutes. Then opening the bottle with the mouth still inverted, let the greatest part of the water run out very gently; after this, turn the bottle with the mouth upwards; pour more water upon the ether, shaking and separating the water as before. Repeat this operation three or four times; after which the ether will be exceedingly pure, and capable of dissolving elastic gum, though it could not do so before."

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As great part of the ether undoubtedly remains mixed with the water after this process, our author remarks, that it might be worth while to put the water into a retort and distil the ether from it, which will come sufficiently pure for common use. He observes also, that "it is commonly believed that water combines with the purest part of the ether when the two fluids are kept together; though the contrary seems to be established by this process. According to Mr Wastrumb, we may obtain from the residuum of vitriolic ether a resin containing vitriolic acid, vinegar, Glauber's salt, selenite, calcareous earth, silex, iron, and phosphoric acid.

## § 2. *Of the* Nitrous *Acid and its Combinations.*

This acid is far from being so plentiful as the vitriolic. It has been thought to exist in the air; and the experiments of Mr Cavendish have shown, that it may be artificially composed, by taking the electric spark in a mixture of dephlogisticated and phlogisticated air. See Aerology, n° 77.

With regard to the preparation of nitre, Dr Black observes, that it is made in great plenty in the more southern parts of Europe; likewise in the southern parts of Persia, in China, the East Indies, and in North America. We have had no accounts of the manner in which it is prepared in the East Indies, no person on the spot having taken particular notice of the manufacture. The general account is, that it is obtained from the soil of certain districts which are called *saltpetre grounds;* where the soil is very cold, barren, and unhealthy. The salt is there ready formed by nature. It is only necessary to gather large quantities of the earth, and to put it into a cavity through which a great quantity of water is poured, which dissolves the nitre; and the lixivium runs into an adjacent pit, out of which it is lifted in order to be evaporated and obtained in the form of crystals. This account, however, has been thought unsatisfactory; because there is hardly any part of Europe in which it is found in this manner. It is discovered indeed in some very large districts in Poland, particularly in Podolia, where the country is flat and fertile, and had been once very populous, but is now in a great measure deserted. It is there obtained from tumuli or hillocks, which are the remains of former habitations; but these are the only places in which it is found in any considerable quantity. In Spain, it is said that the inhabitants extract it from the soil after a crop of corn. It has been found in America in lime-stone grounds, in the floors of pigeon-houses, tobacco-houses, or the ruins of old stables, where a number of putrefying vegetables were once collected. In general, however, it is extracted from artificial compounds or accidental mixtures, where animal and vegetable substances have been fully putrefied by being exposed to the air with any spongy or loose earth, especially of the calcareous kind, and open to the north or north-east wind, and more or less covered from the heat or rains. This last particular is absolutely necessary to its formation in any quantity; for the heat, by evaporating the moisture too much, prevents it from being produced, and the rains wash it away after it is already made. Cramer, an author of the greatest credit, informs us in his Docimastics, that he made a little hut exposed to the fresh air of the country,

724 Of the preparation of nitre.

725 Discovered in some places in Podolia in Poland;

726 In Spain and America.

727 Requisites for its formation.

728 Cramer's artificial compost for making nitre.

Nitrous acid and its combinations.

country, with windows to admit the winds. In this he put a mixture of garden mold, the rubbish of lime, and putrid animal and vegetable substances. This he frequently moistened with urine; and in a month or two found his composition very rich in nitre, yielding at least one-eight part of its weight.

729
How prepared in Hanover.

It is manufactured in Europe by making artificial compounds with less trouble. In Hanover it is got by collecting the rakings of the streets; which are built up into mud-walls that are allowed to remain a certain time, when the surface is found covered with a white saline efflorescence. A person is employed to scrape this off; and putting it into a vessel, it is washed with water to dissolve the nitre, and the remaining earthy matter is again plastered on the mud-walls, and fresh matter brought from the streets to renew them occasionally: and by this simple method a considerable quantity is obtained.

730
In other parts of Germany.

In Germany the peasants are directed by law to build mud-walls of this kind with the dung and urine of animals, and some straw. After they have stood for some time, and the vegetable and animal substances are rotten, they afford a considerable quantity of nitre.

731
In France.

In France it is obtained from accidental collections of this kind; as where loose earth has been long exposed to the contact of animal substances, as the ruins of old stables, pigeon-houses, &c. Sometimes from the mould upon the ground where dunghills have been lying. A particular set of people go about in search of these materials; and when, by making a small essay, they find that they will turn to account, they put the materials into a large tub with a perforated bottom, and another which is water-proof put below it. Some straw is interposed betwixt the two; and on pouring water upon the materials, it soaks through them, undergoes a kind of filtration in passing through the straw, and is then drawn off by a cock placed in the the under-tub, and boiled to a proper consistence for crystallization. The crystals are at first brown and very impure, but by repeated dissolution and crystallization become pure and white.

732
Dr Black's conclusions concerning the nature of saltpetre.

From these particulars relating to the history of saltpetre, Dr Black concludes, that it is not properly a fossil, being produced at the surface of the ground. Margraaf discovered a small quantity of it in the analysis of some of the waters about Berlin, and others have found it in the wells about some great cities: but no true nitre has ever been found in springs; so that this nitrous salt may be supposed to have derived its origin from the quantity of putrid matters with which all cities abound. All rich and fertile soils are found to contain it; and in the hot countries, where the products of nature are numerous, and putrefaction carried on very fast, they are often very rich in nitre. This may happen in some places from the conflux of waters; which remaining for some time on the surface, and afterwards exhaling, left the saline particles behind.

733
Supposed to be the last effect of putrefaction.

On the whole, Dr Black concludes, that neither nitre nor its acid does exist in the air, because it might easily be detected there; though many have embraced this opinion from its being usually found at the surface of the ground. He is of opinion, that it is the effect of the last stage of putrefaction of animal and vegetable substances; and it is never to be found except where these or their effluvia are present, and never till the putrefaction is complete. It has been a matter of dispute, whether it existed in those matters before the process of putrefaction, or was produced by it. But it is pretty certain, says the Doctor, that it originated in them; for the sun-flower, tobacco, and other plants, are found to contain it before putrefaction: and some have even asserted, that plants placed in the earth, deprived of all its saline substances, will yield it. The compositions recommended by Cramer are the fittest for producing a complete degree of putrefaction, provided they contain a moderate degree of humidity, and that the quantity exposed to the air be defended from too great a heat by the sun, which would dry up its moisture; and likewise from too great a degree of cold, which likewise checks fermentation. The importance of the calcareous earth in such a composition would likewise favour the conclusions just now drawn; for the most remarkable effect of this earth is to promote and perfect the putrefaction of these substances. It would seem, therefore, that the true secret of the production of nitre is to mix properly together animal and vegetable substances with earth, particularly of the calcareous kind; exposing them to the air with a moderate degree of humidity, sufficient to promote their putrefaction in the most effectual manner; and when the putrefaction is carried to the utmost height, we may then expect that nitre will be produced.

734
Distinguishing characteristic of the nitrous acid.

The distinguishing characteristic of the nitrous acid is its great disposition to unite with the phlogiston; and, when so united, first to become exceedingly volatile, and at last to be dissipated in a very white bright flame: this is called its *detonation* or *deflagration*. In the strongest state in which this acid is procurable in a liquid form, it is of a reddish yellow colour, and continually exhales in dense, red, and very noxious fumes; and in this state is called *smoking*, or, from its inventor, *Glauber's*, spirit of nitre.

I. To extract the Nitrous Acid by means of the *Vitriolic*.

735
Spirit of nitre.

Into a glass retort put two pounds of good saltpetre, and pour upon it 18 ounces of concentrated oil of vitriol; set the retort in a sand-heat, and lute on a large receiver with the composition already recommended, for resisting acid fumes; the mixture will grow very warm, and the retort and receiver will be filled with red vapours. A small fire is then to be kindled, and cautiously raised till no more drops will fall from the nose of the retort. What comes over will be a very strong and smoking spirit of nitre.

736
Rectification.

In this process, the nitrous acid is generally mixed with part of the vitriolic which comes over along with it, and from which it must be freed if designed for nice purposes. This is most effectually done by dissolving in it a small quantity of nitre, and redistilling the mixture. The vitriolic acid which came over in the first distillation is kept back by the nitre in the second, combining with its alkaline basis, and expelling a proportionable quantity of the nitrous acid.

737
Different methods of distilling.

We have here directed the pure vitriolic acid to be used, in order to expel the nitrous one; but for this purpose any combination of the vitriolic acid with a metallic or earthy basis may be used, though not with equal advantage. If calcined vitriol is made use of, as

Nitrous acid and its combinations.

as much phlogiston is communicated by the calx of iron contained in that salt as makes the nitrous acid exceedingly volatile, so that great part of it is lost. If calcined alum, or selenite, is made use of, the vitriolic acid in these substances immediately leaves the earth with which it was combined, in order to unite with the alkaline basis of the nitre, and expels its acid: but the moment the nitrous acid is expelled from the alkali, it combines with the earth which the vitriolic acid had left; from which it cannot be driven without a violent fire; and part of it remains obstinately fixed, so as not to be expelled by any degree of heat. Hence the produce of spirit, when nitre is distilled with such substances, always turns out considerably less than when the pure vitriolic acid is used. Alum is preferable to selenite, for the purposes of distilling spirit of nitre; because the acid does not adhere so strongly to argillaceous as to calcareous earth.

According to Weigleb, the nitrous acid may be expelled not only by clay, gypsum, and other substances containing the vitriolic acid, but even by various kinds of vitrifiable earth. Clean pebbles, quartz in the form of sand, pieces of broken china and stone ware, powdered glass, *&c* mixed with nitre in the proportion of six to one, always expel the acid, though imperfectly. In France the acid is always extracted by means of clay.

The reason of these decompositions is, that the alkaline basis of the nitre attracts the siliceous earth, whose fixedness in a vehement fire gives it an advantage over the volatile nitrous acid, in the same manner that the weak acid of phosphorus or arsenic will also expel it by reason of their fixedness in the fire.

Even spirit of salt, according to Margraaff's experiments, may be used for distilling the spirit of nitre. That celebrated chemist informs us, that on distilling nitre with eight or nine times its quantity of strong marine acid, a spirit comes over which consists chiefly of the nitrous acid, but has also some portion of that of sea-salt. The reason of this is shown in Mr Kirwant's experiments on chemical attractions*. In the present case, however, the decomposition may be facilitated by the strong attraction of the nitrous acid for phlogiston; for it is well known, that on mixing the nitrous and marine acids together, the latter is always dephlogisticated. It seems therefore that in this case a double decomposition takes place, the nitrous acid uniting itself to the phlogiston of the marine, and the latter attaching itself to the alkali of the nitre.

* See n° 292.

738 Uses.

Spirit of nitre is very useful in the arts of dyeing and refining, where it is known by the name of *aquafortis*; and therefore an easy and cheap method of procuring it is a valuable piece of knowledge. Many difficulties, however, occur in this process, as well as that for the vitriolic acid. Oil of vitriol, indeed, always expels the nitrous acid with certainty; and on distilling the mixture, a spirit of nitre arises; but if a glass retort is used for the purpose of distilling this acid, the quantity of residuum left in distillation is so great, and so insoluble in water, being no other than vitriolated tartar, that the retort must always be broken in order to get it out; and the produce of spirit will scarce afford the breaking a retort. If earthen retorts are made use of, they must certainly be of that kind called stone-ware, and the price of them will be very little if at all inferior to that of glass. Iron pots are said to be made use of in the distillation of common aquafortis in large quantities; but they have the great inconvenience of making a quantity of the acid so volatile, that it not only will not condense, but spreads its suffocating vapours all round in such a manner as to prove very dangerous to those who are near it. If an iron vessel, therefore, is thought of for the purpose of distilling aquafortis, it will be proper at least to attempt luting over the inside with a mixture of gypseous earth and sand, to prevent as much as possible the acid from attracting the metal.

Dephlogisticated spirit of nitre is obtained by distilling the smoking kind with a gentle heat, until what remains is as colourless as water. It is distinguished by emitting white and not red fumes like the other kind, when set in a warm place. It must be kept constantly in the dark, otherwise it will again become phlogisticated, and emit red vapours by the action of the light; the same thing will also take place if it be heated with too violent a fire.

II. To procure the Nitrous Acid by means of *Arsenic*.

Pulverise equal quantities of dried nitre and white crystalline arsenic; mix them well together, and distil in a glass-retort with a fire very cautiously applied; for the arsenic acts on the nitre with such a violence, and the fumes are here so volatile, that unless great care is taken, a most dangerous explosion will almost certainly happen. As, in this case, the nitrous fumes arise in a perfectly dry state, some water must be put into the receiver, with which they may unite and condense. The aquafortis so produced will have a blue colour, owing to the inflammable principle separated from the arsenic, by which its extreme volatility is likewise occasioned. If this blue aquafortis is exposed to the air, its colour soon flies off. If instead of the white arsenic we employ the pure arsenic acid, the distilled liquor will have no blue colour. 739 Blue aquafortis.

Nitrous Acid COMBINED,

I. *With Vegetable fixed Alkali.* This salt, combined with the nitrous acid to the point of saturation, regenerates nitre. It is observable, however, according to Neumann, that there is always some dissimilarity between the original and regenerated nitre, unless quicklime is added. The regenerated salt, he says, always corrodes tin, which the original nitre does not; owing probably to a quantity of phlogisticated acid remaining in it. Boiling with quicklime deprives it of this quality, and makes it exactly the same with original nitre. 740 Salt-petre.

II. *With Fossile alkali.* The neutral salt arising from a combination of the nitrous acid and fossile alkali is somewhat different from common nitre; being more difficult to crystallize, inclining to deliquate in the air, and shooting into crystals of a cubical form, whence it gets the name of *cubic nitre*. Its qualities are found somewhat inferior to the common nitre; and therfore it is never made, unless by accident, or for experiments. 741 Cubic-nitre.

Nitre is one of the most fusible salts. It is liquefied in a heat much less than what is necessary to make it red; and thus remain in tranquil fusion, without swelling. If nitre thus melted be left to cool and fix, whe- 742 Fusibility.

Nitrous acid and its combinations.

whether it has been made red-hot or not in the fusion, it coagulates into a white, semi-transparent, solid mass, called *mineral crystal*, having all the properties of nitre itself. By this fusion, Mr Beaumé observes that nitre loses very little, if any, of the water contained in its crystals, since the weight of mineral crystal is nearly the same with that of the nitre employed.

When nitre is kept in fusion with a moderate heat, and at the same time does not touch any inflammable matter, nor even flame, it remains in that state without suffering any very sensible alteration; but if it is long kept in fusion with a strong fire, part of the acid is destroyed by the phlogiston which penetrates the crucible; and hence the nitre becomes more and more alkaline.

743 Uses.

Nitre is of very extensive use in different arts; being the principal ingredient in gun-powder; and serving as an excellent flux to other matters; whence its use in glass making. (See GLASS.) It is also possessed of a considerable antiseptic power; whence its use in preserving meat, to which it communicates a red colour. In medicine, nitre is used as a diuretic, sedative, and cooler; but very often sits uneasy on the stomach. The resemblance of the crystals of nitre to those of Glauber's salt has sometimes been the occasion of dangerous mistakes. Dr Alexander mentions a swelling over the whole body of a woman, occasioned by her taking a solution of nitre instead of Glauber's salt. Two mistakes of the same kind we have also known. In one an ounce, and in the other upwards of two ounces, of nitre were swallowed. The symptoms occasioned were universal coldness and shivering, extreme debility and sickness at stomach, cold sweats and faintings. Neither of the cases proved mortal. The cure was effected by cordials and corroborants.

744 Sal prunella.

A process has obtained a place in the dispensatories for a supposed purification of nitre by means of flower of brimstone. A pound of salt-petre is to be melted in a crucible, or small iron vessel; and an ounce of flowers of sulphur thrown upon it, by small quantities at a time: a violent deflagration ensues on each addition; and after the whole is put in, the salt is poured out in moulds, and then called *sal prunella*. It has been disputed whether the nitre was at all depurated by this process; Dr Lewis thinks it is not. From our own experience, however, we can affirm, that by this means a sediment falls to the bottom, which carries with it any impurities that may have been in the nitre, and leaves the fluid salt clear and transparent as water. This precipitate is probably no other than a vitriolated tartar formed by the union of the sulphureous acid and alkali of the nitre, which being less fusible than the nitre, subsides in a solid form and clarifies it.

745 Nitrous ammoniac.

III. *With Volatile Alkali.* The nitrous acid seems peculiarly adapted to an union with volatile alkali; saturating as much, or rather more of it than the strongest vitriolic acid is capable of doing. The product is a very beautiful salt, called *volatile nitre*, or *nitrous sal ammoniac*. It very readily dissolves, not only in water, but in spirit of wine, which distinguishes it from the vitriolic and common kind of sal ammoniac. It also requires less heat for its sublimation: indeed care must be taken not to apply too great a heat for this purpose, as the nitrous sal ammoniac has the property of deflagrating by itself without any addition of inflammable matter; and this it does more or less readily, as the volatile alkali with which it was made was more or less impure and oily.

746 Dr Ward's white drop.

The medical virtues of this kind of nitre have not been inquired into. It seems to have made the principal ingredient in the famous Dr Ward's white drop, which was celebrated as an antiscorbutic; with what justice those who have tried it must determine.

747 Calcareous nitre.

IV. *With Calcareous Earths.* These the nitrous acid dissolves into a transparent colourless liquor; but for this purpose it must be very much diluted, or the solution will have a gelatinous consistence. This compound is not applicable to any useful purpose. It has a very acrid taste; and, if inspissated, attracts moisture from the air. If it is totally dried, it then resembles an earthy matter, which deflagrates very weakly. By distillation in a retort, almost all the acid may be expelled, and what little remains flies off in an open fire.

748 Nitrous acid decomposed.

Mr Pott, who has particularly examined the combination of nitrous acid with quicklime, says that the acid suffered remarkable alterations by distillation from quicklime, and repeated cohobations upon it. By these experiments he obtained a salt more sensibly susceptible of crystallization and detonation, than what can be obtained by a single combination. From his experiments it would seem, that nitrous acid, by this treatment with quicklime, was capable of being entirely decomposed.

If a solution of chalk in the nitrous acid be evaporated to dryness, and then gently calcined, it acquires the property of shining in the dark, after having been exposed to the sun's rays, or even to the light of a candle. This substance, from its inventor, is called *Baldwin's phosphorus*; or, from its being necessary to keep it in a glass hermetically sealed, *phosphorus hermeticus*. (See EARTHS). 749 Phosphorus.

V. *With Argillaceous Earths and Magnesia.* All that is known concerning the combinations of nitrous acid with these earths is, that the first produce astringent, and the second purgative compounds, similar to alum and Epsom salt, and which are not susceptible of crystallization.

750 Gold.

VI. *With Gold.*—Till very lately it has been the opinion of chemists, that the nitrous acid by itself was incapable of acting upon this metal.—Dr Brandt, however, produced before the Swedish academy of sciences, a solution of gold in the nitrous acid, obtained in parting, by that acid, a mixture of gold and silver. —The mixed metal was boiled with aquafortis in a glass body fitted with a head and receiver, the liquor poured off, and the coction repeated with fresh parcels of stronger and stronger nitrous spirit, till all the silver was judged to be extracted. The last parcel was boiled down till the matter at the bottom looked like a dry salt; on boiling this in fresh aquafortis in close vessels, as before, a part of the gold was dissolved, and the liquor tinged yellow. But though gold is by this means truly soluble in the nitrous acid, the union is extremely slight; the gold being not only precipitated on the addition of silver, but likewise spontaneously on exposure to the air.—Dr Lewis very justly observes, that this solution may have been often made unknown

unknown to the chemiſt who did ſo; and probably occaſioned the miſtakes which ſome have fallen into, who thought that they were in poſſeſſion of aquafortis capable of tranſmuting ſilver into gold. Notwithſtanding theſe authorities, Mr Kirwan is of opinion that the nitrous acid is in no caſe able to diſſolve gold; the metal being only intimately mixed or diffuſed through it.

**751 Silver.**

II. *With Silver.*—Pure ſpirit of nitre will diſſolve its own weight of ſilver; and ſhoots with it into fine white cryſtals of a triangular form, conſiſting of very thin plates joined cloſely one upon another. Theſe cryſtals are ſomewhat deliqueſcent; of an extremely bitter, pungent, and nauſeous taſte; and, if taken internally, are highly corroſive and poiſonous. They melt in a ſmall heat, and form, on cooling, a dark-coloured maſs ſtill more corroſive, called *lunar cauſtic*, or *lapis infernalis*. They readily diſſolve in water; and, by the aſſiſtance of warmth, in ſpirit of wine. In the *Acta Naturæ Curioſorum*, tom. vi. there is a remarkable hiſtory of ſilver being volatilized by its combination with the nitrous acid. Four ounces of ſilver being diſſolved in aquafortis, and the ſolution ſet to diſtil in an earthen retort, a white tranſparent butter roſe into the neck, and nothing remaining behind; by degrees the butter liquefied, and paſſed down into the phlegm in the receiver. The whole being now poured back into the retort, the ſilver aroſe again along with the acid. The volatilization being attributed to the liquor having ſtood in a laboratory where charcoal was bringing in, the experiment was repeated with a freſh ſolution of ſilver, and a little powdered charcoal, with the ſame event.

**752 Lunar cauſtic.**

**753 Colours produced by ſolution of ſilver.**

Solution of ſilver in the nitrous acid ſtains hair, bones, and other ſolid parts of animals, and different kinds of wood, of all the intermediate ſhades from a light brown to a deep and laſting black. The liquors commonly ſold for ſtaining hair brown or black, are no other than ſolutions of ſilver in aquafortis, ſo far diluted in water as not ſenſibly to corrode the hair.

It gives a permanent ſtain likewiſe to ſundry ſtones; not only to thoſe of the ſofter kind, as marble, but to ſome of conſiderable hardneſs, as agates and jaſpers. The ſolution for this purpoſe ſhould be fully ſaturated with the metal; and the ſtone, after the liquor has been applied, expoſed for ſome time to the ſun. M. du Fay obſerves (in a paper on this ſubject in the French memoirs for 1728), that if the ſolution be repeatedly applied, it will penetrate into the whitiſh agate, or chalcedony, about one-twelfth of an inch: that the tincture does not prove uniform, on account of the veins in the ſtone: that the colours, thus communicated by art, are readily diſtinguiſhed from the natural, by diſappearing on laying the ſtone for a night in aquafortis: that, on expoſing it to the ſun afterwards for ſome days, the colour returns: that the ſolution gave ſomewhat different tinctures to different ſtones; to oriental agate, a deeper black than to the common chalcedony; to an agate ſpotted with yellow, a purple; to the jade ſtone, a pale browniſh; to the common emerald, an opaque black; to common granite, a violet unequally deep; to ſerpentine ſtone, an olive; to marble, a reddiſh, which changed to purple, and fixed in a brown; that on ſlates, talcs, and amianthus, it had no effect.



**754 Arbor Dianæ.**

If a ſolution of ſilver be diluted with pure water, a conſiderable quantity of pure mercury added, and the whole ſet by in a cold place; there will form by degrees a precipitation and cryſtallization reſembling a little tree, with its root, trunk and branches, called *arbor Dianæ*, or the *philoſophic ſilver tree*. Another kind of artificial vegetation may be produced by ſpreading a few drops of ſolution of ſilver upon a glaſs plate, and placing in the middle a ſmall bit of any of the metals that precipitate ſilver, particularly iron. The ſilver quickly concretes into curious ramifications all over the plate.

**755 Solution of ſilver decompoſed.**

Like other metallic ſolutions, this combination of the nitrous acid with ſilver is decompoſed by fixed and volatile alkalies, calcareous earths, and ſeveral metals, (ſee the *Table of Affinities*); but with ſeveral peculiar circumſtances attending the precipitation. With metals, the ſilver is readily and copiouſly thrown down at firſt, but ſlowly and difficultly towards the end. The menſtruum generally retains ſome portion of the ſilver, as the ſilver almoſt always does of the metal which precipitated it. For recovering the ſilver from aquafortis after parting, the refiners employ copper. The ſolution, diluted with water, is put into a copper veſſel, or into a glaſs one with thin plates of copper, and ſet into a gentle warmth. The ſilver begins immediately to ſeparate from the liquor in form of fine grey ſcales, or powder; a part of the copper being diſſolved in its place, ſo as to tinge the fluid more or leſs of a bluiſh green colour. The plates are now and then ſhaken, that ſuch part of the ſilver as is depoſited upon them may fall off, and ſettle to the bottom. The digeſtion is continued till a freſh bright plate, kept for ſome time in the warm liquor, is no longer obſerved to contract any powdery matter on the ſurface; when the liquor is poured off, and the precipitate waſhed with freſh parcels of boiling water. It is obſervable, that though the acid in this proceſs ſaturates itſelf with the copper, in proportion as it lets go the ſilver, yet the quantity of copper which it takes up is not near ſo great as that of ſilver which it depoſits. One drachm of copper will precipitate three of ſilver, and ſaturate all the acid that held the three drachms diſſolved.

**756 Characters curiouſly marked on the inſide of a glaſs by means of the ſun's light.**

Calcareous earths, as chalk or quicklime, throw down a part of the ſilver, but leave a very conſiderable part ſuſpended in the liquor. If the earth be moiſtened with the ſolution into the conſiſtence of a paſte, and expoſed to the ſun, it changes its white colour to a dark purpliſh black; diſtinct characters may be exhibited on the matter, by intercepting a part of the ſun's light by threads, ſlit paper, *&c.* placed on the outſide of the glaſs. Culinary fire does not affect its colour: after the maſs has been exſiccated by this, it changes as before, on expoſure to the ſun.

Mild volatile alkaline ſpirits, added to a ſolution of ſilver, precipitate but little, and cauſtic volatile alkalies none. Pure fixed alkalies, and alkalies rendered cauſtic by quicklime, throw down the whole. Fixed alkalies impregnated with inflammable matter by calcination with animal coals, occaſion at firſt a conſiderable precipitation; but if added to a larger quantity, take up a great part of the metal again. Mr Margraaf relates, that edulcorated calces of ſilver totally diſſolve, both in a lixivium of theſe alkalies and in vo-



latile

Nitrous acid and its combinations.

latile spirits; and that the marine acid precipitates the silver from the volatile, but not from the fixed, alkaline solution. Kunckel reports that the calx precipitated by volatile spirits made with quicklime, fulminates or explodes in the fire; and that by inspissating a solution of pure silver, melting the dry residuum, pouring it on spirit of urine supersaturated with salt, and setting the mixture in a gentle warmth, a blood-red mass is produced, so tough as to admit of being wound about the fingers.

757 Copper.

III. *With Copper.* The nitrous acid very readily dissolves this metal into a green-coloured and very caustic liquor. The solution, if properly evaporated, will crystallize; but the crystals are deliquescent, and therefore difficult to be preserved. The only use of this

758 Verditer.

combination is for the preparation of the pigment called *verditer.* Of this there are two kinds, the blue and green. The blue is by far the brightest colour, and consequently the most valuable. It has been said that this is obtained by precipitating a solution of copper by any calcareous earth; and therefore is sold by the refiners who have large quantities of solution of copper accidentally made. The solution is said to be precipitated by chalk, or whiting; and that the precipitate is the beautiful blue colour called *verditer.* By this method, however, only the green kind can be obtained. The blue we have found to be of a quite different nature, and formed by precipitation with a gentle heat from a solution of copper in volatile alkali. See the article COLOUR-MAKING.

759 Iron.

IV. *With Iron.* On this metal the concentrated nitrous acid acts very violently, and plentifully corrodes, but does not dissolve it; the calx falling almost as fast as dissolved; and when it is once let fall, fresh acid will not take it up again. If the acid was diluted at first, it takes up a considerable porportion, provided the metal be leisurely added. If the solution is performed with extreme slowness, the colour will be green; but if otherwise, of a dark red. It does not crystallize; and, if inspissated to dryness, deliquates in the air.

760 Tin.

V. *With Tin.* Concentrated nitrous acid acts upon tin with great force, but only corrodes the metal into a white indissoluble mass. In order to obtain a perfect solution of tin in the nitrous acid, the metal must be put in by very little at a time, and a diluted aquafortis made use of. This solution has been considerably used in dyeing, and is remarkable for heightening red colours of all kinds; but the solution made with *aqua-regis* is preferable.

761 Lead.

VI. *With Lead.* Proof aquafortis, lowered with an equal quantity of water, dissolves about half its weight of lead. On diluting the solution with a large quantity of water it turns milky, and deposites great part of the metal. The solution shoots, upon exhaling part of the menstruum, into small pyramidal crystals with square bases, of an austere sweet taste.

762 Quicksilver supposed to be extracted from lead.

In the memoirs of the French academy for 1733, there is a particular account of an experiment, in which mercury is said to have been extracted from lead by dissolving in it the nitrous acid. During the dissolution, there fell a precipitate which is plainly proved to be mercury, and was looked upon to be one of the constituent parts of the lead separated by this simple process: it seems probable, however, that the mercury in this case had been contained in the aquafortis; for pure lead dissolved in pure aquafortis gives no such precipitate."

The crystals of lead in the nitrous acid, when thrown into the fire, do not deflagrate as other combinations of this acid with metallic or saline bases; but crackle violently, and fly round, with great danger to the by-standers. If they are rubbed into very fine powder, they may then be melted without any danger. By repeated dissolutions in fresh aquafortis, they at last form a thick fluid like oil, which cannot be dried without great difficulty. This composition is not adapted to any particular use, and is a violent poison.

763 Quicksilver.

VII. *With Quicksilver.* Aquafortis of such a degree of strength as to take up half its weight of silver, dissolves with ease above equal its weight of mercury into a limpid liquor, intensely corrosive and poisonous, which spontaneously shoots into white crystals. These crystals, or the solution exsiccated, and moderately calcined, assume a sparkling red colour; and are used

764 Red precipitate.

in medicine as an escharotic, under the name of *red precipitate.* The precipitate has sometimes been given internally, it is said, in very large quantities; even a whole drachm at one dose. But this would seem incredible; and the pesent practice does not countenance the taking of red precipitate inwardly. This solution seems to have been what gave the efficacy to Ward's white drop.

When red precipitate is prepared in quantity, it is proper to distil the mercurial solution; because most of the aquafortis may then be saved. It is exceedingly pure, if by purity we mean its being free of any admixture of vitriolic or marine acid; but is considerably tainted with the inflammable principle of the mercury extricated during the dissolution. In consequence of this, it is very volatile and smoking; which has generally, though improperly, been taken as a sign of strength in the nitrous acid.

765 Bismuth.

VIII. *With Bismuth.* This semimetal is very readily acted upon by the nitrous acid. Proof aquafortis dissolves about half its weight of bismuth. If the metal was hastily added, the solution proves of a greenish colour; if otherwise, it is colourless and transparent. Unless the acid was diluted with about an equal quantity of water, a part of the bismuth crystallizes almost as fast as it dissolves. The metal is totally precipitated both by fixed and volatile alkalies. The last, added in greater quantities than are sufficient for precipitation, take it up again. The liquor generally appears greenish; by alternate additions of the alkaline spirit and solution, it becomes bluish or purple. Fixed alkalies calcined with inflammable matter likewise dissolve the bismuth after they have precipitated it.

766 Magistery of bismuth.

The only use of this compound is for the precipitate, which is used as a cosmetic, under the name of *magistery of bismuth.* The common way of preparing this is by diluting the solution very largely with water, upon which it turns milky, and a fine white precipitate falls, which is to be well edulcorated with water, and is then employed as a cosmetic both in washes and pomatums.

Concerning the preparation of this cosmetic, Neumann observes, that there are sundry variations.— "Some (says he) takes aqua-regia for the menstruum; and for the precipitant a solution of sea-salt, alkalies, spirit

Nitrous acid and its combinations.

spirit of wine, &c. Some mix with the solution of bismuth a solution of benzoin in spirit of wine, and thus obtain a magistery compounded of bismuth and benzoin. Others add a solution of chalk to the metalline solution, and precipitate both together by alkalies. I have made trial with a good number of different precipitants; and found, that with common fixed alkali and caustic alkali, with watery and vinous alkaline spirits, the magistery was white, and in considerable quantity; the liquor, after the precipitation with volatile spirits, appearing blue. That oil of vitriol threw down a white precipitate very copiously: but that with spirit of salt, or spirit of vitriol, the precipitate was in very small quantity, in colour like the foregoing; distilled vinegar making no precipitation at all. Common rectified spirit of wine, and tartarized spirit, common water, and lime-water, gave white precipitates. Solutions of nitre, vitriolated tartar, sal mirabile, alum, borax, common salt, sal ammoniac, the combination of marine acid with calcareous earth, and terra foliata tartari, all precipitated the bismuth white. With a solution of gold in aqua-regia the magistery proved grey; with a solution of the same metal in aqua-regia made with spirit of salt, the precipitate was likewise grey, and in small quantity; with solution of copper in aquafortis, white, and in very small quantity, the liquor continuing blue; with solution of vitriol of copper, white; with solution of mercury sublimate, white and plentiful; with solution of iron in aquafortis, yellowish; with solution of lead in aquafortis, and of sugar of lead, white; with solution of zinc in aquafortis there was little precipitate; and with solutions of silver, tin, regulus of antimony, and of mercury, in the same acid, none at all."

767 Zinc.

IX. *With Zinc.* Upon this semimetal the nitrous acid acts with greater violence than any other, and will forsake any other metallic substance for it. The whole is very soon dissolved into a transparent colourless liquor. The calces of flowers of zinc are likewise soluble in the nitrous acid; but neither the solution of the flowers, nor of the metal itself, have been yet found applicable to any useful purpose. Neumann remarks, that on extracting with nitrous acid the soluble parts of calamine, which is an ore of zinc, the solution, inspissated to dryness, left a reddish brown mass, which on digestion with spirit of wine exploded and burst the vessel.

768 Regulus of antimony.

X. *With Regulus of Antimony.* The nitrous acid rather corrodes than dissolves this semimetal. The corroded powder forms a medicine formerly used under the name of *bezoar mineral*, but now disregarded.

769 Regulus of cobalt.

XI. *With Regulus of Cobalt.* This semimetal dissolves readily in the nitrous acid, both in its metallic form and when reduced to a calx. The solution is of a red colour. Hence the nitrous acid furnishes means of discovering this semimetal in ores after strong calcination; very few other calces being soluble in the nitrous acid, and those that are not influencing the colour.

770 Regulus of cobalt, how discovered in ores.

XII. *With Nickel.* This semimetal is easily dissolved by the nitrous acid into a deep green liquor; but neither this solution, nor indeed the semimetal of which it is made, has hitherto been found of any use.

XIII. *With Arsenic.* This substance is readily dissolved by the nitrous acid; which abstracts the phlogiston, and leaves the pure arsenical acid behind. See below *Acid of Arsenic.*

Nitrious acid and its combinations.

771 Oils.

XIV. *With Expressed Oils.* These, as well as all other fatty or unctuous substances, are considerably thickened and hardened by their union with the nitrous acid. There is only one preparation where this combination is applied to any use. It is the *unguentum citrinum* of the shops. This is made by adding to some quantity of melted hog's-lard a solution of quicksilver in the nitrous acid. The acid, though in a diluted state, and combined with mercury, nevertheless acts with such force on the lard, as to render the ointment almost of the consistence of tallow.

772 Unguentum citrinum.

773 Spirit of wine.

XV. *With Vinous Spirits.* If highly rectified spirit of wine and strong spirit of nitre are suddenly mixed together, the acid instantly becomes volatile, and is dissipated with great heat and effervescence in highly noxious red fumes. If the acid is cautiously poured into the spirit, in the proportion of five, six, or even ten parts of spirit to one of acid, and the mixture distilled in a glass retort set in a water-bath, an exceedingly fragrant and volatile spirit comes over, used in medicine as a diuretic and cooler, under the name of *spiritus nitri dulcis*. This liquor is not acid; nor has what remains in the retort any more the characteristics of nitrous acid, which seems to be entirely decomposed in this process. (See the following article.)

774 Spiritus nitri dulcis.

775 Nitrous ether.

With the nitrous acid and spirit of wine, may also be made an exceedingly volatile liquor, called *nitrous ether*, to distinguish it from the vitriolic abovementioned. The proportions of nitrous acid and spirit of wine to each other for nitrous ether, are two of the acid by weight to three of the spirit. Dr Black's process for making it is as follows. Take four ounces of strong phlogisticated nitrous acid; and having cooled it by putting it into a mixture of salt and snow, or into water cooled very near the freezing point, by putting pieces of ice into it, he puts it into a phial, and pours upon it an equal quantity of water, likewise cooled very low, in such a manner that the water may float as much as possible on the surface of the spirit. Six ounces of strong spirit of wine are then put in, so as to float in like manner on the surface of the water; the phial is placed in a vessel containing cold water: and so great is the power of cold in restraining the action of bodies, that if the mixture was too cold, no ether would be produced; but at the temperature just mentioned, the ether begins to be formed in a few hours, with some little effervescence, and an expulsion of a small quantity of nitrous air. We must provide for the escape of this elastic fluid, by having an hole in the cork, or the vessel would be broken. The whole of the ether will be formed in a few days, and may be separated from the rest of the liquor by means of a funnel, shaped as in Pl. CXXXIV. fig. 9.

776 Woulfe's process for procuring it in large quantities.

To procure the nitrous ether in large quantities, Mr Woulfe recommends the following process. Put into a retort four pounds of nitre, then mix together four pounds of vitriolic acid, and three pounds five ounces of spirit of wine. These are poured on the nitre by adding only two ounces at a time: the vitriolic acid acting on the nitre, produces a sufficient degree of heat; and the acid of the nitre uniting with the

Nitrous acid and its combinations.

the spirit, forms a nitrous ether, which flies off from the mixture, and is condensed in a number of vessels placed in cold water.—To obtain good nitrous ether readily, and at one distillation, Mr Dollfuss advises to distil four parts of nitre of manganese, four of vitriolic acid, and eight parts of spirit of wine.

777 Inquiry into the nature of ether.

Macquer supposes that ether is the most oily part or quintessence of spirit of wine. But it cannot be proved that ether contains any oil. And, besides, if this were the case, those acids which have the strongest attraction for water would produce the greatest quantity of ether; which is found not to be the case: and it is most probable that ether is produced by a combination of some part of the acid with a portion, particularly the inflammable part, of the spirit of wine; and it has been shown by chemical experiments, that every kind of ether contains a part of the acid employed. Dr Black himself has formed ether without any spirit at all, by exposing nitrous acid highly phlogisticated for some months to the light of the sun. This was owing to the attraction of the principle of inflammability; which it is well known that light has the power of affording to bodies that attract it with force.

### Nitrous Acid DECOMPOSED,

778 Oils fired by spirit of nitre.

I. *By Essential Oils.* If equal quantities of strong nitrous acid and oil of cloves are poured into the same vessel, the mixture instantly takes fire; both acid and oil burning with great fury till only a light spongy coal remains. Dr Lewis observes, that this experiment does not always succeed, and that there are but few oils which can be fired with certainty, without attending to a particular circumstance first discovered by M. Rouelle, and communicated in the French Memoirs for the year 1747. "On letting fall into the oil equal its quantity of acid, the mixture effervesces, swells, and a light fungous coal arises: a little more of the acid poured upon this coal sets it instantly on fire. By this method almost all the distilled oils may be fired by spirit of nitre of moderate strength. Expressed oils also may be set on fire by a mixture of the nitrous acid and oil of vitriol; the use of which last seems to be to absorb the aqueous humidity of the spirit of nitre.

779 Nitre alkalized.

II. *By Charcoal.* By this substance the nitrous acid cannot be conveniently decomposed, unless it is combined with an alkaline or metallic base. For the purpose of decomposing the acid, common saltpetre is most convenient. The proportions recommended by Dr Lewis for alkalisating nitre, are four ounces of the salt to five drachms of powdered charcoal If these are carefully mixed, and injected by little and little into a tubulated retort made red hot, and fitted with a large receiver and a number of adopters, a violent deflagration will ensue on every addition, attended with a great quantity of air, and some vapours which will circulate for some time, and then condense in the vessels. This

780 Clyssus of nitre.

liquor is called *clyssus of nitre*. If sulphur is used instead of nitre, the clyssus is of a different kind, consisting of a mixture of the nitrous and vitriolic acids. The residuum, when charcoal is used, is a very strong and pure alkali; with sulphur it is vitriolated tartar. To prevent the loss occasioned by the violent deflagration, when this operation is performed in open vessels, Dr Black recommends to have the materials somewhat moist.

III. *By Vinous Spirits.* In the process already mentioned for making *spiritus nitri dulcis*, a total decomposition of the acid seems to take place: for neither the dulcified spirit itself, nor the acid matter left in the retort, show any signs of deflagration with inflammable matters, which is the peculiar characteristic of nitrous acid.

Marine acid and its combinations.

781 Residuum of spiritus nitri dulcis analized by Mr Pott.

Mr Pott has given an analysis of the oleaginous residuum of the distillation. Distilled by a stronger fire, it gave over a yellow, acid, slightly empyreumatic spirit; which being saturated with fixed alkali, the liquor evaporated, and the dry neutral salt laid on burning coals, did not deflagrate. After this spirit arose a red empyreumatic oil; and in the bottom of the retort was left a shining black mass like soot; which, burnt in a crucible, left a white fixed earth, convertible by a vehement fire into glass. Another parcel of the above residuum was evaporated to the consistence of pitch. In this state it gave a yellow tincture to spirit of wine, flamed vividly and quietly on burning coals, and at last swelled up like bitumen. Another portion was saturated with alkaline ley, with which it immediately effervesced, and then evaporated as the former. It gave, as before, a yellow colour to rectified spirit of wine, and a much deeper yellow to dulcified spirit of nitre; and in the fire discovered no footstep of detonation. M. Macquer supposes this acid to have been not the nitrous, but the acetous, which enters into the composition of the spirit of wine; and his conjecture is now confirmed by late experiments.

### § 3. *Of the* MARINE *Acid and its Combinations.*

782 Marine acid.

THIS acid is never, at least very rarely, found but in a state of saturation with the mineral alkali; in which case it forms the common salt used in food. Almost the only exception to this is human urine, and perhaps that of some other animals; for there the marine acid is found saturated, not with the mineral, but the common vegetable, fixed alkali. From being found in such plenty in the waters of the ocean, it has the name of *marine acid*.

783 Marine acid thought to be the same with the vitriolic.

It is commonly thought that this acid is no other than the vitriolic, somehow or other disguised by the inflammable principle; to which some have added another, called by them a *mercurial earth*.

The reasons given for this supposition, however, are but very slight, consisting chiefly in the resemblance between the volatile vitriolic acid and the marine, both in the white colour of their vapours, and likewise the great volatility of both. As to the existence of that principle called a mercurial earth, it hath never been proved; and, till that time, can never be allowed to be an ingredient in the composition of any substance whatever. As we do not remember to have read of any experiments where the marine acid was directly produced from that of vitriol, we shall content ourselves with relating one very remarkable fact which happened to fall under our own observation.

784 A transmutation.

As vitriolated tartar, or Glauber's salt, when fused with charcoal dust, is converted into an hepar sulphuris, attempts have been made on this principle to separate the pure alkali from the residuum of Glauber's spirit of nitre and spirit of salt. In an attempt of this kind, which, by the bye, proved unsuccessful, as all others of the same kind must do, 30 or 40 pounds

Marine acid and its combination.

pounds of the mass for Glauber's salt were fused in a strong iron pot, with a sufficient quantity of common coal powdered and sifted. As the quantity of powdered coal was pretty large, the mass was thereby hindered from flowing into thin fusion; and, that the whole might be perfectly alkalisated, it was frequently stirred up with an iron ladle, and kept very intensely heated for some hours. The mass was now taken out by means of an iron ladle, and laid on a flat stone; and, as it was but half fluid, every ladleful concreted into a black irregular saline mass, which had the appearance of a cinder: but which, however, consisted of an hepar sulphuris mixed with some coal-dust. As there was a considerable quantity of this matter, and the ladlefuls were thrown at random above one another, it so happened, that between two or three of the pieces, a kind of chimney was formed, so that there being a small draught of air through the interstices, and the masses containing a quantity of coal-dust, the internal parts were in a state of ignition, while the external were quite cold. From these ignited places a white fume arose; which being collected on the colder masses, assumed the form of white flowers. These were found to be genuine sal ammoniac, composed of a volatile alkali and marine acid; both of which we have the greatest reason to think were produced at that very time, and that a double transmutation took place; namely, of the vitriolic acid into the marine, and of the fixed alkali into the volatile. Our reasons for being of this opinion are, 1. That the matter had been subjected to such an extreme and long continued heat, that, had any sal ammoniac been pre existent in the mixture, it must have certainly been dissipated, as this salt always sublimes with a degree of heat below ignition. 2. Though the matter was taken out of the pot of a very intense red heat, so that the saline part was evidently melted, yet no ammoniacal fume issued from it at that time, nor till the masses had been for some time exposed to the air, and were become cool, excepting only those interstices where the air kept up a burning heat, by a small draught being formed from the situation of the saline masses. 3. In those ignited places, when cool, the fixed salt was entirely decomposed, neither alkaline salt, Glauber's salt, fixed alkali, nor sulphur remaining; but the whole was consumed to a kind of ferruginous ashes. We are therefore of opinion, that the marine acid and volatile alkali are, in some cases, mere creatures of the fire, and most commonly produced at the same time, from the slow combustion of mineral substances. Hence, where heaps of hot cinders are thrown out, small quantities of the true sal ammoniac are always formed, when the ignited ones happen to fall in such a manner as to occasion a small draught of air through them.

785 Dr Priestley's observations on marine acid.

The marine acid, or spirit of salt, is weaker than either the vitriolic or nitrous; though Dr Priestley hath observed, that, when concentrated to the utmost degree, in which state it was perfectly invisible and elastic as air, it was then able to separate the nitrous acid from an alkali. In some other cases, too, it appears not only stronger than the nitrous, but even than the vitriolic; of which we shall take notice in course. —Mr Berthollet says, that he has been able also to procure the marine acid in a solid state, by distilling it in Mr Woulfe's apparatus, kept perfectly cool with ice.

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The yellow colour of the marine acid is sometimes owing to iron, which may be precipitated from it by means of an alkali. In certain cases, however, it is observed to have a much darker and nearly a brown colour, without containing the smallest particle of this metal.—Mr Dollfuss is of opinion, that the yellow colour of the marine acid is owing to a portion of dephlogisticated air which it generally contains. A pretty strong proof that it emits this kind of air indeed is, that a candle will burn longer in a bottle containing some marine acid, than it will in an equal quantity of common air.

### I. To procure the Marine Acid by means of the *Vitriolic*.

786 Spirit of sea-salt.

Put any quantity of sea-salt into a tubulated glass-retort, to which a large receiver is firmly luted, having a quantity of water in it, more or less as you want your spirit of salt to be more or less strong. Having placed your retort in a sand-bath, take of concentrated oil of vitriol half as much as you put salt into the retort. Through the aperture in the upper part of the retort, pour a small quantity of the vitriolic acid; a violent effervescence will immediately arise, and white vapours will ascend, and come over into the receiver. These vapours are the marine acid in its most concentrated state; and, as they are very greedy of moisture, they will unite with the water in a very short time, unless too much oil of vitriol is put in at once; in which case, part of them will be dissipated through the small hole in the receiver. When you perceive the first fumes condensed, add a little more oil of vitriol, taking care to stop the aperture of the retort as soon as you drop in the vitriolic acid, that the marine acid may not escape. Continue this by intervals, till your acid is all put in; and then make a very gentle fire, that the retort may be no warmer than the hand can bear. This degree of heat must be continued a long time, otherwise very much of the acid will be lost. To perform this operation perfectly, no more acid should be forced over, than what the water in the receiver can take up; and by this means the operator's patience will be rewarded with a vastly larger produce of acid than can be procured by hasty distillation. When the vapours become a little more fixed, a greater heat is necessary, but nothing equal to what the nitrous acid requires. For distilling spirit of salt, Mr Wiegleb recommends four pounds of oil of vitriol to six of common salt.—It may also be obtained from the bittern remaining after the crystallization of common salt, by adding one pound of oil of vitriol to five of bittern It may even be obtained from this liquid by simple distillation without any additional acid; but a violent fire will then be necessary, and it is almost impossible to prevent the liquor from swelling and running over the neck of the retort in the beginning of the process.

787 Why distillation of sea-salt with coperas does not succeed.

The marine acid cannot be procured by means of combinations of the vitriolic acid with metallic and earthy bases, as the nitrous is; for though, by means of calcined vitriol, for instance, the marine acid is effectually expelled from its alkaline basis, yet it immediately combines with the calx of iron left by the vitriolic acid, and not only adheres obstinately, but even sublimes the metal; so that what little spirit can be ob-

obtained, is never pure. This inconvenience is not ſo great when uncalcined copperas is made uſe of: for the marine acid has a very ſtrong attraction to water; which partly diſſolves its union with the metalline calx. If gypſum is uſed, inſtead of calcined vitriol, not a drop of ſpirit will be obtained. Alum and ſal catharticus amarus amſwer better.

II. To procure the Marine Acid by means of the *Nitrous*.

788 Aqua-regis.

Take equal quantities of ſea-ſalt and Glauber's ſpirit of nitre; put the ſalt into a retort, and pour on it the nitrous acid; let them ſtand for 10 or 12 hours; then diſtil with a gentle heat; an acid liquor will come over, which is a compound of the nitrous and marine acids, called *aqua-regis*. When the diſtillation is finiſhed, and the veſſels cooled, pour back the diſtilled liquor on the maſs which is left on the retort, and diſtil again: the ſecond produce will be more of the nature of ſpirit of ſea-ſalt than the former. Continue to do this, pouring the diſtilled liquor either on the maſs left in the retort, or upon freſh ſea-ſalt, till you obſerve that no nitrous acid ariſes. No experiments have been made on this ſpirit of ſalt, by which we can judge whether it is different from that procured by the vitriolic acid or not.

III. To procure the Marine Acid, by diſtilling Salt *per ſe*.

789 Spirit of ſalt *per ſe*.

Put into a retort any quantity of common ſalt which has not been dried, and diſtil in a ſand-heat till nothing more will come over. In the receiver you will have a liquor conſiderably more acid than vinegar, in weight about the fourth part of the ſalt employed. On the dry ſalt left in the retort, pour ſome water, ſomewhat leſs in quantity than the liquor which came over. Let it ſtand till the ſalt has thoroughly imbibed the moiſture, and then diſtil again. You will again have an acid, but weaker than the former. Repeat this ſix or ſeven times; after which you will obtain no more marine acid in this way. It has been thought that ſea-ſalt was capable of total decompoſition by means of moiſture alone; but that is found to be a miſtake. The reaſon of any acid being procurable in this way, is the impurity of the common ſalt, which is always mixed with a quantity of ſal catharticus amarus, and of marine acid combined with magneſia, from which laſt it is ſeparable by moiſture. If a pure ſalt be formed by combining marine acid with ſalt of ſoda, no ſpirit will be obtained.

IV. To dephlogiſticate the Marine Acid.

790 Marine acid dephlogiſticated by that of nitre or by mangane ſe.

The marine acid, when mixed either with that of nitre or with mangane ſe, loſes that peculiar ſmell by which it is uſually diſtinguiſhed, and acquires one much more volatile and ſuffocating. When mixed with the former, the compound is called *aqua-regia*; when ſubjected to the action of mangane ſe, the product is called *dephlogiſticated ſpirit of ſalt*.

791 Scheele's method of dephlogiſticating it by mangane ſe.

The method of procuring this acid recommended by Mr Scheele is as follows: Mix common muriatic acid in any quantity with levigated mangane ſe in a glaſs retort; to which lute on with blotting paper a receiver capable of containing about 12 ounces of water. Put about two drachms of liquid into it; and in about a quarter of an hour, or ſomewhat more, a quantity of elaſtic fluid, which is the true dephlogiſticated ſpirit of ſalt, will paſs over, and communicate a yellow colour to the air in the receiver; after which the latter is to be ſeparated from the retort. If the paper has been cloſely applied, a quantity of the air will now ruſh out with ſome violence; a cork muſt therefore inſtantly be put into it, and another receiver applied, having in like manner two drachms of water in it, which will alſo be filled in a ſhort time; and thus may ſeveral phials full of this aerial acid be procured in a ſhort time. Care ſhould be taken, that the retort be placed in ſuch a manner as that any drops of liquid which chance to ariſe may fall down again into it. The water put into the receivers ſeems to condenſe the vapours of the marine acid; and it is moſt proper to uſe ſmall receivers, on account of the great quantity of vapour which is loſt at every operation.

792 Properties of dephlogiſticated ſpirit of ſalt.

The effects of this dephlogiſticated marine acid, which can ſcarcely be condenſed into a liquid, are, 1. The lute is corroded in diſtillation, and the corks become yellow, as from aquafortis. 2. Paper coloured with lacmus becomes nearly white, as well as all vegetable red, blue, and yellow flowers; and the ſame change is likewiſe produced upon the green colour of vegetables; nor can any of theſe colours be recovered either by alkalies or acids. 3. Expreſſed oils and animal fats, expoſed to the vapour, become as tenacious as turpentine. 4. Cinnabar grew white on the ſurface; and when it was waſhed, a pure ſolution of corroſive ſublimate was obtained; but ſulphur was not changed. 5. Green vitriol became red and deliqueſcent; but white and blue vitriol remained unchanged. 6. Iron filings were diſſolved; and on evaporating the ſolution to dryneſs, common muriatic acid was obtained by diſtillation with marine acid. 7. In like manner all the metals, even gold itſelf, were diſſolved; and by precipitation with volatile alkali, the ſolution of gold yielded aurum fulminans. 8. The cauſtic volatile alkali produced a white cloud, and emitted a number of air-bubbles, which on burſting diſcharged an elaſtic vapour. 9. Fixed alkali was changed into common ſalt, which decrepitated in the fire. 10. Arſenic became deliqueſcent, inſects died, and fire was inſtantaneouſly extinguiſhed in the vapour.

793 Miſtake of Stahl accounted for.

Theſe phenomena proceed from the ſtrong attraction of dephlogiſticated marine acid for the phlogiſton it has loſt; and which is one of the eſſential parts of it, without which it can ſcarce at all be condenſed into a liquor. "Perhaps (ſays Mr Scheele) Stahl obtained ſuch a dephlogiſticated muriatic acid by means of iron; and from the yellow colour of the cork was led to ſuppoſe that the muriatic acid had been changed into the nitrous. If you make a mixture of mangane ſe, muriatic acid, or diluted vitriolic acid, and alcohol; and after ſome days digeſtion diſtil it by a gentle fire, no efferveſcence enſues: but the ſpirit of wine goes over; and, what is very remarkable, has a ſtrong ſmell of nitrous ether.

2d 793 New ſalt reſembling nitre by Mr Berthollet.

A new ſalt has been produced by Mr Berthollet from the union of dephlogiſticated ſpirit of ſalt with vegetable alkali. This appears to be of the nitrous kind, as having a cool taſte and detonating ſtrongly in the fire. The compound was in very ſmall quantity, and ſeemed to require more pure air for its compoſition than an equal bulk of acid. The greateſt part of the ſalt produced was the common ſalt of Sylvius, or digeſtive ſalt, formed by a combination of the phlogiſticated marine

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rine acid with alkali. Six parts of the dephlogisticated acid are required to give their air to one of the salt. When the fixed alkali is employed, some of the dephlogisticated acid escapes with the pure air; and in general, when not exposed to a bright heat, the salt we speak of is formed. Some of the dephlogisticated acid remains in its proper form after the salt is made, and may be separated by the volatile alkali. It is to be observed, that if the caustic alkali be employed, and the solution much concentrated, even though not under the influence of a bright light (for it is the light which produces the extrication of the dephlogisticated air*), a great effervescence will ensue, and a quantity of dephlogisticated air escape; whence of consequence, little salt can be obtained.

* See *Aërology*, n° 36, *et seq.*

This salt is soluble in greater quantity in hot than in cold water; and not only detonates like nitre, but with much greater violence. The reason is, that, like nitre, it not only contains dephlogisticated air, but has it in greater quantity; an hundred grains of salt giving 75 of air. Attempts have been made to procure gunpowder by means of this salt, but as yet they have been attended with little success.

The other properties of this salt as yet discovered are, that it shoots into rhomboidal crystals; it does not precipitate mercury, silver, or lead, from their solutions in nitrous acid; and it gives out its air again in such a pure state as scarcely to be paralleled in any other substance.

With the mineral alkali the dephlogisticated acid forms a deliquescent salt, soluble in spirit of wine; and which, even in a fluid state, detonates with burning charcoal. With lime, when so far quenched that the air in its interstices is separated, the dephlogisticated acid unites but weakly. It may be recovered from the lime, however, provided the light be obscure, with very little loss, and almost unchanged.

Marine Acid COMBINED,

794 Sal digestivus sylvii.

I. *With Vegetable Fixed Alkali.* This combination is accidentally formed after the distillation of volatile salts, by means of salt of tartar (see *Alkaline Salts*). It was formerly known by the name of *sal digestivus Sylvii;* and a process for making it was inserted in the dispensatories, under the name of *spiritus salis marini coagulatus;* but as it has been found to possess no virtues superior, or even equal, to common salt, it is fallen into disuse.

The crystals of this kind of salt are not cubical, like those of common salt, but parallelopipeds, and if thrown into the fire crack and leap about with violence. They are soluble in greater quantity by hot water than cold; and therefore are crystallized by evaporating the solution to a pellicle, and then letting it cool.—It is very remarkable, that though by a direct combination of vitriolic acid with vegetable fixed alkali, the salt called *vitriolated tartar* is formed; yet if this alkali is once saturated with spirit of salt, so as to form a *sal digestivus*, upon the decomposition of this salt by means of oil of vitriol, the residuum of the distillation will not be a vitriolated tartar, but a salt easily soluble in water, and which bears a strong resemblance to Glauber's salt. Whether, by means of spirit of sea-salt, the vegetable alkali could be converted into the mineral, or salt of soda, is a question well worthy of being solved.

II. *With Mineral Alkali.* This combination is the common alimentary salt, and is never made but for experiment's sake; as the marine acid cannot be had but from sea-salt. For the extraction of this salt from sea-water, see the article SALT.

795 Sal ammoniac.

III. *With Volatile Alkali.* The produce of this combination is the common sal ammoniac, which is used in different arts, and which has the property of making tin unite very readily with iron and copper, so is much used by coppersmiths and in the manufactory of tinned iron.

Sal ammoniac is usually sold in large semi-transparent cakes, which are again capable of being sublimed into masses of the like kind. If they are dissolved in water, the salt very easily shoots into small crystals like feathers. Exposed to a moist air, it deliquates. It is one of the salts which produces the most cold by its solution; so as to sink the thermometer 18 or 20 degrees, or more, according to the temperature of the atmosphere. According to Mr Gellert, a solution of sal ammoniac has the property of dissolving resins. According to Neumann, the volatility of sal ammoniac is so much diminished by repeated sublimations, that at last it remains half fluid in the bottom of the subliming vessel. In its natural state, it sublimes with a degree of heat necessary to melt lead. Pott says, that a small quantity of sal ammoniac may be produced by distilling sea-salt with charcoal, or with alum, or by distilling marine acid with Armenian bole. The same author affirms, that the inflammability of sulphur is destroyed by subliming it with twice its quantity of sal ammoniac.

796 How made.

The method of making this salt was long unknown; and it was imported from Egypt, where it was said to be prepared by sublimation from soot alone, or from a mixture of sea-salt, urine, and soot. That it should be produced from soot alone is very improbable; and the other method, from the known principles of chemistry, is absolutely impossible. The composition of this salt, however, being once known, there remained no other desideratum than a method of procuring those competent parts of sal ammoniac sufficiently cheap, so as to afford sal ammoniac made in Britain at a price equally low with what was imported. The volatile alkali is to be procured in plenty from animal substances or from soot; and the low price of the vitriolic acid made from sulphur affords an easy method of decomposing sea-salt, and obtaining its acid at a low rate. A sal ammoniac work has, accordingly, been established for several years past in Edinburgh; the principal material made choice of for procuring the volatile alkali is soot; and though no persons are admitted to see the work, the large quantities of oil of vitriol brought into it, and the quantities of genuine *sal mirabile* which are there made, evidently show that the process for making sal ammoniac also produces Glauber's salt, by the decomposition of common salt by means of vitriolic acid. The method of conducting the process is unknown; but it is plain that there can be no other difficulty than what arises from the volatility of the vapours of the alkali and of the marine acid. In the common way of distilling those substances, a great part of both is lost; and if it is attempted to make sal ammoniac by combining these two when distilled by the common apparatus, the pro-

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duce will not pay the cost; a little ingenuity, however, will easily suggest different forms and materials for distilling-vessels, by which the marine acid and volatile alkali may be united without losing a particle of either.

If a solution of vitriolic or Glauber's secret sal ammoniac is mixed with sea-salt, the vitriolic acid seizes the alkaline basis of the sea-salt, and expels the marine acid; which immediately unites with the volatile alkali left by the vitriolic acid, and forms a true sal ammoniac. If this solution is now evaporated to dryness, and the saline mass sublimed, the sal ammoniac rises, and leaves a combination of vitriolic acid and mineral alkali at the bottom. This fixed mass being dissolved, filtered, and evaporated, affords Glauber's salts. This has sometimes been thought a preferable method of making sal ammoniac, as the trouble of distilling the marine acid was thereby prevented; but it is found vastly inconvenient on another account, namely, that when sal ammoniac is mixed with any fixed salt, it is always more difficult of sublimation, and a part of it even remains entirely fixed, or is destroyed. The mass of Glauber's salt also, by reason of the inflammable and oily matter contained in impure volatile alkalies, is partly changed into a sulphureous mass, so that the solution refuses to crystallize; at least the operation is attended with intolerable trouble.

797 Fixed sal ammoniac.

IV. *With Earths*. The combinations of this acid with earths of any kind have never been found applicable to any purpose, and therefore they are seldom made or inquired into. The combination with calcareous earth is indeed pretty frequently made accidentally, in the distillation of volatile alkali from sal ammoniac by means of chalk or quicklime. When melted in a crucible and cooled, it appears luminous when struck, and has been called *phosphorus scintillans*. See EARTHS.

798 Phosphorus.

799 Solution of gold in spirit of salt.

V. *With Gold*. The marine acid has no action on gold in its metallic state, in whatever manner the acid be applied; but if the metal is previously attenuated, or reduced to a calx, either by precipitation from aqua-regis or by calcination in mixture with calcinable metals, this acid will then perfectly dissolve, and keep it permanently suspended. Gold, precipitated from aqua-regis by fixed alkalies, and edulcorated by repeated ablutions, may be dissolved even in a very weak spirit of salt by moderate digestion. This solution appears of the same yellow colour as that made in aqua-regis; gives the purple stain to the skin, feathers, bones, and other solid parts of animals; the same violet stain to marble; and strikes the same red colour with tin. Even when common aqua-regia is made use of for the menstruum, it seems to be chiefly by the marine acid in that compound liquor that the gold is held in solution. In distillation the nitrous acid arises, and the marine acid remains combined with the gold in a blood-red mass, soluble, like most of the combinations of metallic bodies with this acid, in spirit of wine. If, towards the end of the distillation, the fire is hastily raised, part of the gold distils in a high saffron-coloured liquor; and part sublimes into the neck of the retort in clusters of long slender crystals of a deep red colour, fusible in a small heat, deliquating in the air, and easily soluble in water. By repetitions of this process the whole of the gold may be elevated, except a small quantity of white powder whose nature is not known. —This red sublimate of gold is said to be easily fusible with the heat of one's hand, and to be shown by the Papists for the blood of St Januarius; the sublimate contained in a phial, being warmed by the hands of the priests who hold it, constitutes the miracle of that saint's blood melting on his birth-day.

800 Blood of St Januarius.

801 Silver.

VI. *With Silver*. Strong spirit of salt corrodes leaf-silver into a white powder, but has no effect on filings or larger masses of the metal. If applied in the form of vapour to masses of silver, and strongly heated at the same time, it readily corrodes them. Thus, if filings, grains, or plates, of silver are mixed with about twice their weight of mercury sublimate, and exposed to a moderate fire, in a retort, or other distilling vessel, a part of the marine acid in the sublimate will be separated and unite with the silver, leaving the mercury to arise in the form of mercurius dulcis. Marine acid is commonly supposed to be incapable of dissolving silver into a liquid state; but Henckel relates, that if red silver ore, which consists of silver intimately mixed with red arsenic, be digested in spirit of salt, the silver will be extracted and kept permanently dissolved.

802 Luna cornea.

The combination of marine acid with silver is called *luna cornea*. The most ready way of preparing it is by dissolving silver in the nitrous acid, and then adding spirit of salt, or a solution of sea-salt, when a precipitation instantly ensues; the marine acid expels the nitrous, and uniting with the silver, falls to the bottom in form of a white powder. The same precipitation would take place, if a solution of silver was made in the vitriolic acid.

803 Its properties.

Luna cornea weighs one-fourth more than the silver employed; yet, when perfectly washed, it is quite insipid to the taste. It does not dissolve in water, spirit of wine, aqua-fortis, or aqua-regis; but is in some small degree acted upon by the vitriolic acid. It melts in the fire as soon as it grows red-hot; and, on cooling, forms a ponderous brownish mass, which being cast into thin plates, becomes semitransparent, and somewhat flexible, like horn; whence its name *luna cornea*. A stronger fire does not expel the acid from the metal, the whole concrete either subliming entire, or passing through the crucible. It totally dissolves in volatile alkaline spirits without any separation of the metal. Exposed to the fire in a close copper vessel, it penetrates the copper, and tinges it throughout of a silver colour. Kunckel observes, that when carefully prepared, melted in a glass vessel, and suffered to cool slowly, to prevent its cracking, it proves clear and transparent; and may be turned into a lathe and formed into elegant figures. He supposes this to be the preparation which gave rise to the notion of malleable glass.

804 Copper.

VII. *With Copper*. In the marine acid, copper dissolves but slowly. The solution, if made without heat, appears at first brown; but, on standing for some time, deposits a white sediment, and becomes green. On adding fresh copper, it becomes brown again, and now recovers its greenness more slowly than before. The white sediment, on being barely melted, proves pure and perfect copper of the same colour as at first. Copper calcined by fire communicates a reddish colour to this acid.

805 Iron.

VIII. *With Iron*. The marine acid acts upon iron less

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less vehemently than the nitrous, and does not dissolve so much; nevertheless, it attacks the metal briskly, so as to raise considerable heat and effervescence, and dissolve it into a yellow liquor. During the solution, an inflammable vapour arises as in the solution of this metal by vitriolic acid. This solution of iron does not crystallize. If it is evaporated, it leaves a greenish

806 Iron volatilized.

saline mass, which is soluble in spirit of wine, and runs in the air into a astringent yellow liquor. On distillation, some of the acid separates, and towards the end of the operation the spirit becomes yellow. This is followed by a yellowish, or deep reddish sublimate, which glistens like the scales of fishes; leaving behind a substance which consists of thin, glossy plates, like talc.

807 Tinctura martis.

The solution of iron in spirit of salt, with the addition of some spirit of wine, is used in medicine as a corroborant, under the name of *tinctura martis*. The sublimate of iron is also used for the same purpose, and called *ens veneris*, or *flores martiales*. It is commonly directed to be prepared by subliming iron filings and sal ammoniac together. In the process, the

808 Flores martiales.

sal ammoniac is partly decomposed, and a caustic alkaline liquor distils. Then the undecomposed sal ammoniac, and the martial sublimate abovementioned, arise together. The sublimate has a deeper or lighter yellow colour, according as it contains more or less iron. The name *ens veneris* is improper. It was given by Mr Boyle, who discovered this medicine. He imagined it to be a preparation of copper, having made use of a colcothar of vitriol containing both iron and copper. A me-

2d 808 Bestuchef's tincture.

dicine of this kind was lately sold with great reputation on the Continent, under the name of *Bestuchef's nervous tincture*. It was introduced by M. Bestuchef Field Marshal in the Russian service: but not long after it came into vogue in Prussia and other northern kingdoms of Europe: it made its appearance also in France, under the name of *General de la Motte's golden drops*. This happened through the infidelity of Bestuchef's operator, who, for a sum of money, violated the oath of secrecy he had taken to Bestuchef, and discovered the secret to de la Motte. To the latter it proved a very valuable acquisition; for he not only procured a patent for it from the king of France in 1730, with the exclusive privilege of selling it, but had a handsome pension settled upon him; selling his medicine besides a half a Louis d'or per phial.

3d 808 Mistakes concerning it.

The attention of the public was particularly drawn to these drops, by their remarkable property of losing their yellow colour in the sun, and regaining it in the shade, which induced many to believe that they contained gold; and in which opinion they were encouraged by de la Motte. Even chemists of no little reputation were deceived by this appearance; and M. Beaumé, imagining he had discovered the secret, published a preparation to the world as the true arcanum of la Motte's drops. It consisted of a calx of gold precipitated from aqua-regia by means of fixed alkali, and redissolved in nitrous acid, to which was added a large quantity of spirit of wine. Others, however, who could find nothing but iron by an analysis

4th 808 True method of preparing it.

of the drops, refused their assent; and at length, in 1780, M. Beaumé's mistake was made evident by the publication of the process at the desire of the empress of Russia, who gave 3000 rubles for the receipt. The original *recipe* is perplexed, tedious, and expensive; but when deprived of its superfluous parts, is nearly as follows. Six pounds of common pyrites and twelve of corrosive sublimate are to be triturated together, and then sublimed six or eight times till all the mercury is expelled. The residuum is to be boiled three times with thrice its quantity of water, and as often filtered, and lastly, distilled to dryness. By increasing the fire, a martial salt is at last sublimed into the neck of the retort; to three drachms of which are to be added 12 ounces of highly rectified spirit of wine, and the whole exposed to the rays of the sun. This is the yellow tincture; but there was also a white one, which, however, seems to be but of little value. It is made by pouring on the residuum of the last sublimation twelve pounds of highly rectified spirit of wine, and drawing it off by a gentle distillation after a few

5th 808 Supposed to absorb phlogiston from the sun's rays.

days digestion.—Mr Klaproth imagines, from the following experiment, that Bestuchef's tincture absorbs phlogiston from the rays of the sun. He poured a few drops of a solution of tartar into two ounces of distilled water, and divided this into two parts. Into one glass having poured a few drops of the tincture that had not been exposed to the sun, the iron was precipitated in the usual form of a yellow ochre; but on treating in the same manner a portion of the tincture that had been exposed to the solar rays, the precipitate fell of a bluish green colour.

809 Solution of tin.

IX. *With Tin.* Though the concentrated marine acid has a greater attraction for tin than any other acid, it does not readily dissolve this metal while the acid is in its liquid state; but may be made to dissolve it perfectly by the addition of a small quantity of spirit of nitre. Neumann observes, that an ounce of spirit of salt, with only a scruple of spirit of nitre, dissolved tin perfectly: but on inverting the proportions, and taking a scruple of marine acid to an ounce of the nitrous, four scruples, or four and an half, of tin, were dissolved into a thick pap; some more of the marine acid being gradually added, the whole was dissolved into a clear liquor. In making these solutions, a small quantity of black matter usually subsides.

The solution of tin is sometimes colourless; sometimes of a bluish, or yellow colour, according to different circumstances of the process. It is of the greatest consequence in dyeing, by not only heightening the colours, but making them more durable (See Dyeing). It shoots into small crystals; and, if inspissated, deliquates in the air.

810 Smoking liquor of Libavius.

Marine acid in its concentrated state volatilizes tin, and forms with it a thick liquor, which, from its inventor, is called *smoking liquor of Libavius*. To prepare this smoking liquor, an amalgam must be made of four parts of tin and five of mercury. This amalgam is to be mixed with an equal weight of corrosive mercury, by triturating the whole together in a glass mortar. The mixture is then to be put into a glass retort, and the distillation performed with a fire gradually increased. A very smoking liquor passes into the receiver; and towards the end of the distillation, a thick, and even concrete matter. When the operation is finished, the liquor is to be poured quickly into a crystal glass-bottle, with a glass stopper. When this bottle is opened, a white, copious, thick, the poignant fume issues, which remains long in the air without disappearing.

The acid in this liquor is far from being saturated, and

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and is capable of still dissolving much tin in the ordinary way. From this imperfect saturation, together with its concentration, proceeds partly its property of smoking so considerably: nevertheless, some other cause probably concurs to give it this property; for though it smokes infinitely more than the most concentrated spirit of salt, its vapours are, notwithstanding, much less elastic. It has all the other properties of concentrated marine acid when imperfectly saturated with tin. If it is diluted with much water, most of the metal separates in light white flocks. In dyeing, it produces the same effects as solution of tin made in the common way. If the distillation is continued after the smoking liquor of Libavius has come over, the mercury of the corrosive sublimate will then arise in its proper form.

811 Lead.

X. *With Lead.* Marine acid, whether in its concentrated or diluted state, has little effect upon lead, unless assisted by heat. If spirit of salt is poured on filings of lead, and the heat is increased so as to make the liquor boil and distil, a part of the acid will be retained by the metal, which will be corroded into a saline mass; and this, by a repetition of the process, may be dissolved into a limpid liquor. If lead is dissolved in aquafortis, and spirit of sea-salt, or sea-salt itself, added, a precipitation of the metal ensues; but if some aqua-regia is added, the precipitate is redissolved.

812 Plumbum corneum.

The combination of lead with marine acid, has, when melted, some degree of transparency and flexibility like horn; whence, and from its resemblance to luna cornea, it is called *plumbum corneum.* This substance is used in preparing phosphorus, according to Mr Margraaf's method.

813 Quicksilver.

XI. *With Quicksilver.* Marine acid in its limpid state, whether concentrated or diluted, has no effect upon quicksilver, even when assisted by a boiling heat; but if mercury is dissolved in the vitriolic or nitrous acids, and sea-salt, or its spirit, is added to the solution, it immediately precipitates the quicksilver in the same manner as it does silver or lead. If concentrated marine acid, in the form of vapour, and strongly heated, meets with mercury in the same state, a very intimate union takes place; and the produce is a most violent corrosive and poisonous salt, called *corrosive sublimate mercury.* This salt is soluble, though sparingly, in water; but is far from being perfectly saturated with mercury; for it will readily unite with almost its own weight of fresh quicksilver, and sublime with it into a solid white mass (which, when levigated, assumes a yellowish colour) called *mercurius dulcis, aquila alba,* or *calomel.*

814 Corrosive sublimate.

815 Different methods of making.

There have been many different ways of preparing corrosive mercury, recommended by different chemists. Neumann mentions no fewer than ten. 1. From mercury, common salt, nitre, and vitriol. 2. From mercury, common salt, and vitriol. 3. Mercury, common salt, and spirit of nitre. 4. Solution of mercury in aquafortis, and salt. 5. Solution of mercury in aquafortis, and spirit of salt, or the white precipitate. 6. Mercury, common salt, nitre, and oil of vitriol. 7. Edulcorated turbith mineral, and common salt. 8. Red precipitate, common salt, and oil of vitriol. 9. Edulcorated turbith mineral, and spirit of salt. 10. Mercury, sal ammoniac, and oil of vitriol.

From a view of these different methods, it is evident, that the intention of them all is to combine the marine acid with quicksilver; and as this combination can be effected without making use of the nitrous acid, the greatest chemists have imagined that this acid, which is by far the most expensive of the three, might be thrown out of the process altogether, and the sublimate be more conveniently made by directly combining marine acid and mercury in a process similar to the distillation of spirit of salt. This method was formerly recommended by Kunckel; then published in the memoirs of the Academy of Sciences for 1730; and has been adopted and recommended by Dr Lewis.

The process consists in dissolving mercury in the vitriolic acid, as directed for making turbith mineral. The white mass remaining on the exsiccation of this solution is to be triturated with an equal weight of dried salt, and the mixture is then to be sublimed in a sand-heat; gradually increasing the fire till nothing more arises.

816 Differences of quality.

Neumann observes, that there is a considerable difference in the quality of sublimates made by the different methods he mentions; particularly in those made with or without nitre. This we have also found to be the case; and that sublimate made without the nitrous acid is never so corrosive, or soluble in water, as that which is made with it: nor will it afterwards take up so large a quantity of crude mercury as it otherwise would, when it is to be formed into calomel. The above process, therefore, tho' very convenient and easy, is to be rejected; and some other in which the nitrous acid is used, substituted in its stead. The reason of these differences is, that the spirit of salt must by some means or other be dephlogisticated before it can unite in sufficient quantity with the metal, into the compound desired, which is accomplished by the addition of nitrous acid.

From Tachenius, Neumann gives us the following process, which he says was the method of making sublimate at London, Venice, and Amsterdam. Two hundred and eighty pounds of quicksilver, 400 pounds of calcined vitriol, 200 pounds of nitre, the same quantity of common salt, and 50 pounds of the caput mortuum remaining after a former sublimation, or (in want of it) of the caput mortuum of aquafortis, making, in all, 1130 pounds, are well ground, and mixed together; then set to sublime in proper glasses placed in warm ashes, the fire is increased by degrees, and continued for five days and nights. In the making such large quantities, he says, some precautions are necessary, and which those constantly employed herein are best acquainted with. The principal are, the due mixture of the ingredients, which in some places is performed in the same manner as that of the ingredients for gun-powder: that a head and receiver be adapted to the subliming glass, to save some spirit of nitre which will come over. (Here a bent tube of glass will answer the purpose, as already mentioned). The fire must not be raised too hastily. When the sublimate begins to form, the ashes must be removed a little from the sides of the glass, or the glass cautiously raised up a little from the ashes. (This last, we think, is highly imprudent.) Lastly, the laboratory must have a good chimney, capable of carrying off the noxious fumes. The above-mentioned quantities commonly yield 360 pounds of sublimate; the 280 pounds of quicksilver gaining 80 from the 200 pounds of sea-salt. The makers of sublimate

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limate in France, he says, employ, in one operation, only 20 pounds of mercury. This they dissolve in aquafortis, evaporate the solution to dryness, mix the dry matter with 20 pounds of decrepitated sea-salt and 60 of calcined vitriol, and then proceed to sublimation.

817 Observations on the different methods.

The above processes, particularly the last, are unexceptionable as to the production of a sublimate perfectly corrosive; but the operation, it is evident, must be attended with considerable difficulty, by reason of the large quantity of matter put into the glass at once. We must remember, that always on mixing a volatile salt with a quantity of fixed matter, the sublimation of it becomes more difficult than it would have been had no such matter been mixed with it. It is of considerable consequence, therefore, in all sublimations, to make the quantity of matter put into the glass as little as possible. It would seem more proper, instead of the calcined vitriol used in the processes last mentioned, to dissolve the mercury in the vitriolic acid, as directed in turbith mineral, and sublime the dry mass mixed with nitre and sea-salt.

818 Supposed adulteration with arsenic.

It has been said, that corrosive sublimate mercury was frequently adulterated with arsenic; and means have even been pointed out for detecting this supposed adulteration. These means are, to dissolve a little of the suspected salt in water, and add an alkaline lixivium to precipitate the mercury. If the precipitate was of a black colour, it was said to be a certain sign of arsenic. This, however, shows nothing at all, but that either the alkali contains some inflammable matter, which, joining with the precipitate, makes it appear black; or that the sublimate is not perfectly corrosive; for if a volatile alkali is poured on levigated *mercurius dulcis*, the place it touches is instantly turned black.

819 Mercurius dulcis.

Mercurius dulcis, or calomel, is prepared by mixing equal parts, or at least three of quicksilver with four of sublimate; after being thoroughly ground together in a glass or stone mortar, they are to be poured through a long funnel into a bolt-head, and then sublimed. The medicine has been thought to be improved by repeated sublimations, but this is found to be a mistake. Mr Beaumé has found that mercurius dulcis cannot be united with corrosive sublimate in the way of sublimation; the former, by reason of its superior volatility, always rises to the top of the vessel.

820 Zinc volatilized.

XII. *With Zinc.* This semimetal dissolves readily in the marine acid into a transparent colourless liquor. It is volatilized, as well as most other metallic substances by this combination, as appears from the following process delivered by Neumann.

"Equal parts of filings of zinc and powdered sal ammoniac being mixed together, and urged with a gradual fire in a retort; at first arose, in a very gentle heat, an excessively penetrating volatile spirit, so strong as to strike a man down who should inadvertently receive its vapour freely into the nose. This came over in subtile vapours, and was followed by a spirit of salt in dense white fumes. In an open fire, white flowers succeeded; and at length a reddish and a black butter. In the bottom of the retort was found a portion of the zinc in its metallic form, with a little ponderous and fixed butyraceous matter which liquefied in the air. The lump was far more brittle than zinc ordinarily is; of a reddish colour on the outside, and blackish within. The bottom of the retort was variegated with yellow and red colours, and looked extremely beautiful. The remaining zinc was mixed afresh with equal its weight of sal ammoniac, and the process repeated. A volatile alkaline spirit and marine acid were obtained as at first; and in the retort was found only a little black matter. When the zinc was taken at first in twice the quantity of the sal ammoniac, the part that preserved its metallic form proved less brittle than in the foregoing experiment, and the retort appeared variegated in the same manner. On endeavouring to rectify the buttter, the retort parted in two by the time that one half had distilled." The nature of this combination is unknown.

821 Butter of antimony.

XIII. *With Regulus of Antimony.* This semimetal cannot be united with the marine acid unless the latter is in its most concentrated state. The produce is an excessively caustic thick liquid, called *butter of antimony*. The process for obtainining this butter is similar to that for distilling the smoking spirit of Libavius. Either crude antimony, or its regulus, may be used: for the spirit of salt will attack the reguline part of this mineral without touching the sulphureous. Three parts of corrosive sublimate are to be mixed with one of crude antimony; the mixture to be digested in a retort set in a sand-heat; the marine acid in the sublimate will unite with the reguline part of the antimony. Upon increasing the fire, the regulus arises, dissolved in the concentrated acid, not into a liquid form, but that of a thick unctuous substance like butter, from whence it takes its name. This substance liquefies by heat, and requires the cautious application of a live coal to melt it down from the neck of the retort. By rectification, or exposure to the air, it becomes fluid like oil but still retains the name of butter. If water is added to butter of antimony, either when in a butyraceous form, or when become fluid by rectification, the antimony is precipitated in a white powder called *powder of algaroth*, and improperly *mercurius vitæ*. This powder is a violent and very unsafe emetic. The butter itself was formerly used as a caustic; but it was totally neglected in the present practice, until lately that it has been recommended as the most proper material for preparing emetic tartar. (See below.) Mr Dollfuss recommends the following method as the best for making butter of antimony; *viz.* two ounces and a quarter of the grey calx of antimony, eight ounces of common salt, and six of acid of vitriol. By distilling this mixture, ten ounces of the antimonial caustic were obtained; and in order to determine the quantity of metal contained in it, he mixed two ounces of the caustic with four ounces of water; but thus such a strong coagulum was formed, that he was not able to pour off any of the water even after standing 24 hours. The precipitate, when carefully dried, weighed 50 grains. The result was much the same when glass of antimony was used, only that the precipitate was much more considerable, half an ounce of the caustic then yielding 60 grains, though at another time only 50 grains were obtained. In the residuum

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siduum of the former experiment he found 30 grains of an earthy substance, chiefly a combination of calcareous earth with muriatic acid.

When the mercurius vitæ precipitates, the union between the marine acid and regulus is totally dissolved; so that the powder, by frequent washings, becomes perfectly free from every particle of acid, which unites with the water made use of, and is then called very improperly, *philosophic spirit of vitriol.*

822 Sympathetic ink.

XIV. *With Regulus of Cobalt.* Pure spirit of salt dissolves this semimetal into a reddish yellow liquor, which immediately becomes green from a very gentle warmth. On saturating the solution with urinous spirits, the precipitate appears at first white, but afterwards becomes blue, and at length yellow. If the nitrous acid is added to solutions of regulus of cobalt, they assume a deep emerald green when moderately heated, and on cooling become red as at first. Duly evaporated, they yield rose-coloured crystals, which change their colour by heat in the same manner. This solution makes a curious sympathetic ink, the invention of which is commonly ascribed to M. Hellot, though he himself acknowledges that he received the first hint of it from a German chemist in 1736. Any thing wrote with this solution is invisible when dry and cold; but assumes a fine green colour when warm, and will again disappear on being cooled; but if the heat has been too violent, the writing still appears. M. Hellot observes, that if nitre or borax be added to the nitrous solution, the characters wrote with it become rose-coloured when heated; and if sea-salt is afterwards passed over them, they become blue; that with alkali sufficient to saturate the acid, they change purple and red with heat.—A blue sympathetic ink may be made from cobalt in the following manner. Take of an earthy ore of cobalt, as free from iron as possible, one ounce. Bruise it, but not to too fine a powder. Then put it into a cylindrical glass, with 16 ounces of distilled vinegar, and set the mixture in hot sand for the space of six days, stirring it frequently; or else boil it directly till there remain but four ounces. Filter and evaporate it to one half. If your solution be of a rose colour, you may be certain that your cobalt is of the right sort. A red brown colour is a sign of the solution containing iron; in which case the process fails. To two ounces of the solution thus reduced, add two drachms of common salt.—Set the whole in a warm place to dissolve, and the ink is made.

823 Oil of arsenic.

XV. *With Regulus of Arsenic.* This substance is soluble in all acids; but the nature of the compounds formed by such an union is little known. If half a pound of regulus is distilled with one pound of corrosive sublimate, a thin smoking liquor and a butyraceous substance will be obtained, as in making the smoking liquor of Libavius. By repeated rectifications, this butter may be almost all converted into spirit. If equal parts of the arsenic and sublimate are used, a ponderous black oil comes over along with the spirit, which cannot be mixed with it. By rectification in a clean retort they will become clear, but still will not incorporate. If they are now returned upon the red mass remaining in the first retort, and again distilled, a much more ponderous oil than the former will be obtained.

824 Marine ether.

XVI. *With Inflammable Substances.* The acid of sea-salt is very little disposed to contract any union with the phlogiston, while in a liquid state; and much less so, even in its most concentrated state, than either the vitriolic or nitrous. Mr Beaumé, however, has found, that a small quantity of ether, similar to that prepared with the vitriolic and nitrous acids, may be obtained by causing the fumes of the marine acid unite with those of spirit of wine. Others, and particularly some German Chemists, attempted to make this liquor, by employing a marine acid previously combined with metallic substances, such as butter of antimony. The smoking liquor of Libavius succeeds best. If equal parts of this liquor and highly rectified spirit of wine are distilled together, a considerable quantity of true ether is produced; but which, like the vitriolic and nitrous ether, must be rectified in order to its greater purity. The tin contained in the smoking liquor is separated and precipitated in white powder. In this process, the acid is probably more disposed to unite with the spirit of wine, by having already begun to combine with the inflammable principle of the metal.—For marine ether, Mr Dollfuss recommends to put into a retort four ounces of digestive salt previously well dried and powdered, and two ounces of manganese; pouring upon this a mixture of five ounces of spirit of wine and two of oil of vitriol; the first five ounces and a half of the distilled liquor being poured back on the residuum, and the whole afterwards drawn off by a gentle heat. The spirit of salt thus obtained had a very penetrating agreeable odour, somewhat like that of nitrous ether; and at first swam upon the top of water; but at length mixed with it on being agitated for a long time. Towards the end of the distillation a little oil was obtained, which did not mix with the water; and by the addition of four ounces more of spirit of wine, more of the dulcified acid was obtained. With regard to this kind of ether, however, Mr Westrumb denies that it can be made by any method hitherto known; and insists, that all the liquids as yet produced under the name of marine ether are in reality dulcified spirit of salt, and not true ether, which will swim on the top of water.

825 Attraction for phlogiston.

Dr Priestley has observed, that the pure marine acid, when reduced to an invisible aerial state, has a strong affinity with phlogiston; so that it decomposes many substances that contain it, and forms with them an air permanently inflammable. By giving it more time, it will extract phlogiston from dry wood, crusts of bread not burnt, dry flesh; and, what is still more extraordinary, from flints. From what has been above related, it appears that the dephlogisticated spirit of salt has a very strong attraction for phlogiston.

Essential oil of mint absorbed the marine acid air pretty fast, and presently became of a deep brown colour. When taken out of this air, it was of the consistence of treacle, and sunk in water, smelling differently from what it did before; but still the smell of the mint was predominant. Oil of turpentine was also much thickened; and became of a deep brown colour, by being saturated with acid air. Ether absorbed the air very fast; and became first of a turbid white, and then of a yellow and brown colour. In one night a considerable quantity of strongly inflammable air was produced.

Having once saturated a quantity of ether with acid air,

air, he admitted bubbles of common air to it, through the quickſilver by which it was confined, and obſerved that white fumes were made in it, at the entrance of every bubble, for a conſiderable time. Having at another time, ſaturated a ſmall quantity of ether with this kind of air, and the phial which contained it happenning to be overturned, the whole room was inſtantly filled with a white cloud, which had very much the ſmell of ether, but peculiarly offenſive. Opening the door and window of the room, this light cloud filled a long paſſage and another room. The ether, in the mean time, was ſeemingly all vaniſhed: but, ſometime after, the ſurface of the quickſilver in which the experiment had been made was covered with a very acid liquor, ariſing probably from the moiſture in the atmoſphere, attracted from the acid vapour with which the ether had been impregnated. This ſeems to ſhow, that however much diſpoſed the marine acid may be to unite with phlogiſtic matters when in its aerial ſtate, the attraction it has for them is but very ſlight, and ſtill inferior to what it has for water.

Camphor was preſently reduced into a fluid ſtate by imbibing this acid air; but there ſeemed to be ſomething of a whitiſh ſediment in it. After continuing two days in this ſituation, water was admitted to it, upon which the camphor immediately reſumed its former ſolid ſtate; and to appearance was the ſame ſubſtance that it had been before.

Strong concentrated oil of vitriol, being put to marine acid air, was not at all affected by it in a day and a night. In order to try whether it would not have more power in a condenſed ſtate, it was compreſſed with an additional atmoſphere; but, on taking off this, the air expanded again, and was not in the leaſt diminiſhed. A quantity of ſtrong ſpirit of nitre was alſo put to it without any ſenſible effect. From theſe laſt experiments it appears, that the marine acid is not able to diſloge the other acids from their union with water.

2d 825 New acid diſcovered by Mr Homberg.

Beſides the acids already mentioned, Mr Homberg deſcribes an artificial one generated by mixing two ounces and a half of luna cornea, with an ounce and a half of tin calcined alone and without addition, by means of fire. The mixture is to be expoſed to a naked fire in a coated retort, of which two-thirds ought to be left empty; when a browniſh matter, an ounce and a half in weight, will adhere to the neck of the retort. This matter is tin combined with the marine acid, and the reſiduum is ſilver deprived of the ſame acid, which may therefore now be melted together without any loſs. The ſublimate, well powdered and dried, is to be equally divided into two phials, and ſublimed; by repeating which operation two or three times, a volatile ſalt, of an acid nature, very white and tranſparent, is obtained. The reſiduum of theſe ſublimations is always calx of tin.

## § 4. *Of the* Fluor *Acid.*

826 Firſt diſcovered by Mr Margraaf.

This acid was diſcovered ſome time ago by Mr Margraaf, and more fully inveſtigated by Mr Scheele. The experiments by which it was originally produced, and its properties aſcertained, are as follows:

827 How prepared.

I. Two ounces of concentrated vitriolic acid were poured upon an equal quantity of fluor, which had been previouſly pounded in a glaſs mortar, and then put into a retort, to which a receiver was adapted, and the juncture cloſed with grey blotting paper. On the application of heat, the maſs began to effervesce and ſwell, inviſible vapours penetrated every where through the joining of the veſſels, and towards the end of the proceſs white vapours aroſe, which covered all the internal parts of the receiver with a white powder.—The maſs remaining in the retort was as hard as a ſtone, and could not be taken out without breaking the veſſel. The lute was quite corroded and friable.



828 Forms a white earthy cruſt with water

II. The proceſs was repeated exactly in the ſame manner, excepting only that a quantity of diſtilled water was put into the receiver. A white ſpot ſoon began to form on the ſurface of the water, juſt in the centre, and immediately under the mouth of the retort. This ſpot continually increaſed, till at laſt it covered the whole ſurface of the water, forming a pretty thick cruſt, which prevented the communication of the water with new vapours that came over. On gently agitating the receiver, the cruſt broke, and fell to the bottom; ſoon after which a new cruſt like the former was produced. At laſt the receiver, and ſoon after the retort alſo, became white in the inſide. The veſſels, when cooled, were found much corroded internally. In the receiver was an acid liquor mixed with much white matter, ſeparable by filtration.

829 Which has the properties of ſiliceous earth.

III. This white matter when edulcorated and dried, ſhowed itſelf to be ſiliceous earth by the following properties. 1. It was rare, friable, and white. 2. It was not ſenſibly ſoluble in acids. 3. It did not make a tough paſte with water, but was looſe and incoherent after being dried. 4. It diſſolved by boiling in lixivium tartari, and the ſolution in cooling aſſumed a gelatinous conſiſtence. 5. In its pure ſtate it ſuffered no change in the ſtrongeſt heat; but when mixed with alkali, it boiled, frothed up, and formed a glaſs in a melting heat. 6. It diſſolved in borax without ſwelling.

830 Scheele's experiment to determine the origin of this earth.

IV. To determine whether this earth was formed during the proceſs, he poured vitriolic acid upon powdered fluor contained in a cylinder of braſs which was cloſed exactly with a cover, after having ſuſpended over the mixture an iron nail and a bit of charcoal. On opening the veſſel two hours afterwards, he found the nail and charcoal unchanged; but on moiſtening them, he found both covered with a white powder in a ſhort time. This powder had all the properties of ſiliceous earth; and as in the experiment he had made no uſe of glaſs veſſels, he concluded that it did not proceed from the glaſs veſſels as might have been ſuſpected from their being ſo much corroded, but was generated in ſome other way.

831 Artificial fluor yields a ſimilar reſult.

V. Having recompoſed fluor by ſaturating the acid with calcareous earth, he treated the compound in the ſame manner as the natural fluor, with a ſimilar reſult; and repeating the experiment five times over, he conſtantly found the ſiliceous earth and acid diminiſh conſiderably, ſo that at laſt ſcarce any mark of acidity was left. Thence he concluded, that all the fluor acid united itſelf by degrees with the vapours of the water, and thus formed the ſiliceous earth. "It may be objected (ſays Mr Scheele), that the fluor acid is perhaps already united by nature with a fine ſiliceous powder, Fluor acid and its combnations.

der, which it volatilizes, and carries over in distillation, but leaves it as soon as it finds water to unite with, just as muriatic acid parts with the regulus of antimony, when butter of antimony is dropped into water. But if this was the case, the fluor acid would leave the whole quantity of siliceous earth thus combined with it in the first distillation, and therefore show no mark of its presence in the following processes. When I put spirit of wine into the receiver instead of water no siliceous earth was produced; but the alcohol became sour. When I put an unctuous oil into the receiver, all the fluor acid penetrated through the crevices of the lute, and neither united with the oil, nor produced a siliceous earth. This happened also when acid of vitriol was put into the receiver. If therefore the siliceous earth was not a product of each distillation, but, being previously contained in the acid, was only deposited from it in consequence of the union of the acid with a third substance, I think the siliceous earth ought equally to appear when alcohol was put into the receiver, with which it unites, as well as with water; but as this does not happen, I conclude that not all the siliceous earth, which is deposited upon the surface of water during the distillation of the fluor acid, was previously dissolved in this acid."

832 Mr Scheele's conclusion that the earth proceeds from an union of the acid with water.

833 Contested by Messrs Boullanger Monnet, &c.

This opinion of Mr Scheele did not meet with general approbation. M. Boullanger endeavoured to show, that the fluor acid is no other than the muriatic intimately combined with some earthy substance; and Mr Monnet maintained that it is the same with that of vitriol volatilized by some extraordinary connection with the fluor; which opinion was also maintained by Doctor Priestley. Mr Scheele contested these opinions, but found much greater difficulty in supporting his own opinions than in overthrowing those of his adversaries. Boullanger insisted that fluor acid precipitates the solutions of silver and quicksilver, producing luna cornea with the former, and mercurius dulcis with the latter. Mr Scheele owns that fluor acid precipitates both these metals, but the precipitate obtained is in very small quantity, and the little that is produced arises only from a small quantity of sea-salt with which the fluor, as well as all other calcareous substances, is generally mixed. The greatest part of the acid, therefore, will not precipitate the solutions of these metals, which it ought to do upon Mr Boulanger's hypothesis. Mr Scheele then proceeds to show a method of separating this small quantity of marine acid from that of fluor. A solution of silver made with nitrous acid is to be precipitated with alkali of tartar, and as much acid of fluor poured upon the edulcorated powder as is sufficient to give an excess of acid; after which the solution is to be filtered. This solution of silver in fluor acid is then to be dropped into that acid we desire to purify, till no more precipitation ensues; after which the acid is filtered through grey paper, and distilled to dryness in a glass retort. The aqueous part comes over first, but is soon followed by fluor acid, which covers the inside of both the vessels, together with the surface of the water in the receiver, with a thick siliceous crust. The acid thus rectified, does not precipitate solution of silver in the least, or otherwise show the smallest sign of muriatic acid.

834 Their opinions shown to be erroneous by Mr Scheele.

835 Fluor acid proved to be different from that of sea-salt,

That the fluor acid is different from that of vitriol Mr Scheele proved by the following experiment. Upon one ounce of pure levigated fluor with alkohol, he poured three ounces of concentrated oil of vitriol, and distilled the mixture in a sand-bath, having previously put 12 ounces of distilled water into the receiver. He then took other three ounces of the same acid diluted with 24 ounces of water, to which he afterwards added lixivium tartari previously weighed, till he attained the exact point of saturation. After the distillation he weighed the remaining lixivium; having kept up such a degree of heat for eight hours as was not sufficient to raise the vitriolic acid. On breaking the retort, and reducing the mass to powder he boiled it in a glass vessel with 24 ounces of water for some minutes; after which he added just as much lixivium tartari as he had found before to be requisite for the saturation of three ounces of the vitriolic acid, and continued the boiling for a few minutes longer. On examining the solution, it was found to contain a vitriolated tartar perfectly neutralized, neither acid nor alkali prevailing in any degree; which showed that no vitriolic had passed into the receiver. The saline matter being then extracted with hot water, the remaining earth was found to weigh 9¼ drachms. Two drachms of this dissolved in muriatic acid, excepting only a small quantity of matter which seemed to be fluor undecomposed, and which on being dried weighed only nine grains. Into one part of this solution he poured some acid of sugar, and into another vitriolic acid. The former produced saccharated lime, and the latter gypsum. A third part was evaporated to dryness, and left a deliquescent salt; and the remaining part of the earth burned in a crucible, produced a real quick lime.

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836 And from that of vitriol.

837 Quicklime the basis of fluor.

Thus it appeared that the real basis of fluor is quicklime, and likewise that the fluor acid is different from that of vitriol, as appears farther from the following considerations: 1. Pure fluor acid does not precipitate terra ponderosa, nor solution of lead in nitrous acid. 2. The same acid, when saturated with alkali of tartar, evaporated to dryness, and afterwards melted with powdered charcoal, does not produce any hepar sulphuris.

838 Mistake of Mr Monnet on this subject.

Mr Monnet, in order to support his hypothesis, denies that fluor contains any calcareous earth. In proof of which he adduces the following experiment: Equal quantities of alkali and fluor were melted together, with little or no change on the mineral; for, after having taken away by lixiviation the alkali employed, he dissolved the fluor remaining on the filter in nitrous acid, adding vitriolic acid to the solution; and because he obtained no precipitate, concluded at once, that fluor contains no calcareous earth. Mr Scheele on the contrary affirms, that all solutions of fluor yield a precipitate of gypsum whenever vitriolic acid is added to them. He explains Mr Monnet's failure, by supposing that he had diluted his solution with too great a quantity of water.

839 Wiegleb's experiments on the origin of the siliceous earth

Mr Wiegleb, dissatisfied with the hypothesis of Scheele, as well as others, concerning the fluor acid, began a new set of experiments on the mineral. Having first accurately repeated those made by Mr Scheele, he proceeded to inquire into the origin of the siliceous earth, in the following manner: Having first weighed the retort destined for the experiment in

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an accurate manner, and found that its weight was two ounces and five drachms, he put into it two ounces of calcined fluor in powder, adding, by means of a glass tube, $2\frac{1}{4}$ ounces of oil of vitriol. The retort was then placed on the furnace; and a receiver, which when empty weighed two ounces, two drachms, and 30 grains, and now contained two ounces of distilled water, was luted to it. The distillation was conducted with all possible care, and at last pushed till the retort grew red hot; but it was found impossible to prevent a few vapours from penetrating through the lute. Next day the retort, separated from the receiver, was found to weigh, together with its contents, five ounces, five drachms, and 30 grains; and consequently had lost in weight one ounce, three drachms, and 30 grains. The receiver, which, with the water, had originally weighed four ounces, two drachms, and 30 grains, now weighed five ounces and three drachms, and had therefore gained one ounce and 30 grains. This gain, compared with the loss of the retort, shows that the retort lost more by three drachms than the receiver gained; so that these must have undoubtedly passed through the luting in form of vapour.

To determine the point in question, the empty vessels, with what had been put into them, were accurately weighed; when the weights and loss upon the whole were found to be as follows.

| | oz. | dr. | gr. |
|---|---|---|---|
| The empty retort | 2 | 5 | 0 |
| Calcined fluor | 2 | 0 | 0 |
| Oil of vitriol | 2 | 4 | 0 |
| Total weight before distillation | 7 | 1 | 0 |
| After it | 5 | 5 | 30 |
| Loss of retort | 1 | 3 | 30 |
| The empty receiver weighed | 2 | 2 | 30 |
| The water put into it | 2 | 0 | 0 |
| Total weight before distillation | 4 | 2 | 30 |
| Total weight after distillation | 5 | 3 | 0 |
| Gain of receiver | 1 | 0 | 30 |

Deducting this grain of weight in the receiver from the loss of weight in the retort, we find, that three drachms were wanting on the whole, which must undoubtedly, as already observed, have been dissipated in vapour. The retort being now broken, and the dry earth both in its neck and arch separated as accurately as possible, it was found to weigh three drachms; the residuum in the retort weighed three ounces, two drachms, and 40 grains. Now, as the mass in the retort had originally weighed four ounces and four drachms, it appeared, by deducting the residuum, to have suffered, on the whole, a loss of one ounce, one drachm, and 20 grains. To determine the loss more accurately, the following calculations were made:

| | oz. | dr. | gr. |
|---|---|---|---|
| The white earth separated from the neck and arch of the retort | 0 | 3 | 0 |
| Gain of the receiver | 1 | 0 | 30 |
| Lost in vapour | 0 | 3 | 0 |
| Total | 1 | 6 | 3 |

Here Mr Wiegleb was surprised to find, that the matter which came from the retort amounted to more by five drachms ten grains than the mass in the retort had lost of its original weight; to illustrate which it was necessary to weigh the retort and receiver by themselves. The pieces of the retort now weighed only one ounce seven drachms and 50 grains; whereas, before the process, the weight of the retort was two ounces five drachms. It appeared, therefore, that it had lost five drachms ten grains, the very quantity which had been gained by the receiver. This last had lost nothing of its original weight.

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The fluid in the receiver was next diluted with four ounces of distilled water, and the whole poured out on a filter, in order to separate the earthy matter with which it was mixed, and fresh water poured upon it to take out all the acid: after which the earth was dried, and found to weigh 57 grains. The clear liquor was then diluted with more distilled water, and afterwards precipitated with spirit of sal ammoniac prepared with fixed alkali. A brisk effervescence took place before any precipitate began to fall, but ceased soon after the precipitation took place. The whole mixture become gelatinous; and the precipitate, when dry, weighed two drachms. The whole quantity of earth, therefore, obtained in this process amounted to five drachms 47 grains, which is forty-seven grains more than the retort had lost in weight. This excess is, by our author, attributed to part of the acid still adhering to it, and to the accession of some moisture from the air; to determine which he heated each of the parcels of earth red hot separately, and thus reduced them to four drachms 52 grains, which is less by 18 grains than the loss of the retort, and which, he is of opinion, must have escaped in the three drachms of vapour.

840 The earthy crust proceeds from the solution of the glass distilling vessels.

From this experiment Mr Wiegleb concludes, that the earth produced in the distillation of fluor proceeds neither from the spar nor from a combination of the acid with water, but from the solution of the glass by the sparry acid. To his opinion also Dr Crell accedes. "In distilling fluor (says he) with oil of vitriol, I have found the retort as well as the receiver very much corroded. I poured the acid obtained by the process into a phial furnished with a glass stopper, and observed after some time considerable deposition. I then poured the liquor into another phial like the former; and that it might neither on the one hand attack the glass, nor on the other compose siliceous earth with the particles of water, according to Mr Scheele's hypothesis, I added highly rectified spirit of wine. I saw, however, after some time, another considerable deposition. This seemed also to proceed from the glass that had been before dissolved, which the acid let fall in consequence of the gradual combination with the spirit of wine; otherwise we must suppose, what to me appears incredible, that the acid decomposes the spirit, attracts the water, and forms the earth."

841 Mr Meyer's examination of the fluor acid.

This singular acid has been still further examined by Mr Meyer. He informs us, that, among Mr Scheele's experiments, he was particularly struck by one in which no earthy crust was obtained, after putting spirit of wine into the receiver. Mr Meyer repeated this experiment, hoping, that when but little spirit was put into the receiver, he might be able to procure a new kind of ether. An ounce of finely powdered fluor, which had been previously heated red hot, was put into a

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glass retort, to which was fitted a receiver containing three ounces of highly rectified French brandy. The distillation was continued for three hours with a gentle heat: when the acid, having made its way through the bottom, put and end to the process. No crust could be perceived on the surface of the spirit: but in the place where it had been in contact with the receiver there was a thin ring of transparent jelly. The same mixture of oil of vitriol and fluor was therefore again put into a retort of very strong glass, and the same spirit put into the receiver. The distillation was conducted two hours with a gentle and afterwards with a stronger, heat. When it was half over, the spirit began to change into a thin jelly; and at the end of the process some firmer pieces were found at the bottom. These were washed with spirit of wine; and in order to obtain the spirit together with the acid in a pure state, it was put into a large retort, and again subjected to distillation. As the retort grew warm, the opal-coloured spirit became clear and swelled, what remained becoming again gelatinous; a good deal of earth remained behind, but did not adhere firmly to the retort, which was smooth in the inside, though full of shallow excoriations. It was also evident, that the glass was actually corroded, and that the earthy matter is not a mere crust adhering to the inside. The jelly being thoroughly edulcorated, as well as the earth that remained in the retort after the rectification, and that which was dissolved in the water precipitated by spirit of sal ammoniac, the whole quantity amounted to two drachms. That which had separated spontaneously was semitransparent. "As this earth (says he) showed the properties of siliceous earth, and the glass, which was so much corroded, consists in great measure of it, the greatest part of it might come from the glass, and the rest of it perhaps be a constituent part of the fluor itself. In order to ascertain this it was necessary to obtain the fluor acid quite free from siliceous earth. I therefore exposed the ley, which I had procured by the precipitation of the earth with sal ammoniac, to a gentle evaporation in a slightly covered glass vessel. The product was one drachm 56 grains of an ammoniacal salt; the glass did not appear to have been attacked. Half a drachm of this salt was sublimed in a small retort, which, towards the end of the operation, was laid on the bare fire. No crust appeared on the surface of the water in the receiver. At the bottom of the retort lay a little flocculent earth of a light grey colour, above which the internal surface was covered with a white pellicle that reflected various colours; and in the neck there was a sublimate. The thin pellicle easily separated in many places from the glass, which was smooth beneath, though not without some small furrows. I poured water both upon the ammoniacal salt and crust; in consequence of which it acquired a very sour taste, and coloured the tincture of turnsole red. The white crust that was left behind undissolved weighed five grains, and melted into a green glass without addition. This was nothing but the glass that had been corroded by the fluor acid; but as this acid can be set loose only by strong heat, it had done no more than corrode the glass, without passing over along with it in the form of vapour, and then deposing it again on the water. For, upon pouring two drachms of oil of vitriol upon half a drachm of this ammoniacal salt

842 How to procure the acid free from siliceous earth.

a little moistened, and placed in a glass retort, a great foam arose, and the thick vapours that ascended covered the water in the receiver with a white crust. A scruple of the salt on solution, left behind a grain of earth, which, as I conjecture, it had taken up during the evaporation in the glass vessel."

To prevent this, our author distilled half an ounce of fluor with an ounce of oil of vitriol for five hours. The crusts were separated from the water; they weighed, after being well washed and dried, eleven grains; they were white and very flocculent; thirty-two grains of siliceous earth were precipitated from the filtered water: the ley was then evaporated in a leaden vessel and yielded 80 grains of salt. As glass vessels were no longer to be trusted, a piece of a gun-barrel furnished with a cover, and terminated by a bent tube, intended to serve instead of the neck of a retort, was afterwards used; and with this apparatus the following experiments were made:

843 Experiments made with an iron distilling vessel.

1. Half a drachm of the newly prepared sal-ammoniac was distilled for two hours with two drachms of oil of vitriol, into a glass receiver containing an ounce of water. No vestige of a crust could be perceived on the water, but some earth was perceived in the receiver, where the vapours having ascended through the tube, came into contact with the wet glass; and here the surface was become sensibly rough. On the addition of volatile alkali, a few flocculi of siliceous earth, amounting only to one-fourth of a grain, were thrown down out of the water.

2. A drachm of vitriol was added to a drachm and an half of the salt; but a leaden receiver was now used, containing an ounce of water as before. The water acquired an unpleasant smell, but showed no signs of a crust. On the addition of spirit of sal ammoniac, a little grey earth weighing half a grain fell to the bottom.

844 No crust formed by mixing sand with a salt containing fluor acid.

3. A scruple of this salt, mixed with an equal quantity of white sand in fine powder, and distilled with a drachm and an half of oil of vitriol, into an ounce of water in the leaden receiver, showed no sign of a crust. The water had a putrid smell, and left on the filter two grains and an half of grey earth, which ran under the blow-pipe into a grain of lead. Volatile alkali precipitated five grains of grey earth, which melted on the addition of a little salt of tartar into a black globule, though the blow-pipe alone made no change in it.

845 But a great one by using powdered glass.

4. To 13 grains of the same ammoniacal salt a drachm of oil of vitriol and two scruples of green glass, broken into small pieces, were added. The iron tube had scarce become warm, when a great crust of siliceous earth was perceived on the surface of the water, and the same appearance on the moist sides of the vessel. It did not, however, seem to increase during the remainder of the distillation. A grain and a quarter of earthy matter remained on the filter, consisting partly of white films, which ran under the blow-pipe into a greenish glass.

5. To ascertain this matter still more clearly, a different species of mineral fluor was used, which being distilled with a double quantity of oil of vitriol, and with a drachm of water in the receiver, yielded a thin pellicle of the appearance of lead, but no siliceous crust. Volatile alkali threw down $2\frac{1}{4}$ grains of grey earth.

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earth.—A drachm mixed with the same quantity of pulverized sand afforded a pellicle of lead interspersed with a few particles of white crust, which ran into glass under the blow-pipe. Volatile alkali precipitated eight grains.—A drachm, mixed with an equal quantity of green glass reduced to powder, swelled a good deal, and yielded a thick siliceous crust.

6. To a drachm of green fluor that had been heated and powdered were added two drachms of oil of vitriol, still employing the iron tube. A piece of wet charcoal was also suspended in the inside, a cover fixed on the tube, and the latter was heated for about 15 minutes in a sand-bath. Observing now that the charcoal was dry, and had no earth upon it, a scruple of sand in fine powder was added, the charcoal was wetted and replaced, but nothing appeared. Some bits of green glass were then thrown into the mixture which instantly foamed up and ran over. The charcoal was not replaced in the tube, nor was it any longer necessary, as it gained a covering of white powder by being held a very few moments over the orifice.

846 An experiment of Mr Scheele's explained.

Mr Scheele, in one of his experiments, observes, that he observed the white powder on a piece of charcoal that had been moistened and suspended over fluor to which vitriolic acid was added. As this experiment was made in metallic vessels, Mr Meyer conjectures, that the mortar used for reducing the fluor to powder was of soft glass, and that the phenomenon was occasioned by the abrasion of some particles of glass.

847 Of the quantity of siliceous earth carried along with fluor acid.

7. To determine whether the acid can carry up much more of the siliceous earth than is sufficient to saturate it, an ounce and an half of pure oil of vitriol was added in a retort of glass, and three ounces of water put into the receiver. The retort was corroded through in an hour's time, and the crust on the water weighed ten grains The liquid being then filtered and divided into two equal parts, one was precipitated with caustic volatile, and the other with mild fixed vegetable alkali. The former yielded 25 grains of siliceous earth, and the latter 68 grains of a precipitate, which flowed under the blow-pipe, ran into the pores of charcoal, and gave out strong vapours of fluor acid. The reason of this difference shall be explained when we come to treat of siliceous earth.

848 Violent action of fluor acid upon glass.

8. To a mixture of half an ounce of fluor and the same quantity of glass, in powder, 12 drachms of oil of vitriol were put in a small retort, half filled with the mixture. The ingredients acted upon each other so violently that they rose up into the neck of the retort; and the operation being intermitted on account of the noxious vapour they emitted, the retort was found next day covered with fasciculated crystals like hoarfrost.—The experiment being repeated in a more capacious retort, and the mixture thoroughly blended by agitation, it became a thick mass, and swelled like dough in fermentation: the bottom of the retort grew very hot, and the siliceous crust appeared on three ounces of water in the receiver. The distillation being continued for three hours, 16 grains of siliceous earth were found on the surface, and the precipitate by volatile alkali weighed 56 grains; the retort was much less corroded than usual.

9. Thirty grains of this precipitate, distilled in a glass retort with a drachm and an half of oil of vitriol, produced no siliceous earth on the water in the receiver, or that with which the earth was edulcorated. The ley of fluorated volatile alkali was mixed with a solution of chalk in nitrous acid till no more precipitation took place. The mixture was passed through nitrous acid, and the precipitate edulcorated. It weighed, when dry, two drachms and 36 grains.

10. Two drachms of oil of vitriol being added to a drachm of this precipitate contained in a glass retort, the precipitate was attacked in the cold, but no crust appeared; the heat, however, was scarce applied, when the whole surface of the water was covered, and the same phenomena exhibited which are produced by the natural fluor.

849 Farther proofs that the earthy crusts proceeds from the glass vessels.

11. Mr Scheele having observed that a mixture of fluor as transparent as mountain crystal, and oil of vitriol in a metallic cylinder, produced no appearance of siliceous earth, on a wet sponge suspended on the inside, at Mr Meyer's request he made a new experiment by adding oil of vitriol to portions of fluor of this transparent kind placed in two tin cylinders; some siliceous earth was put into one, and a wet sponge suspended in both. The next morning the sponge that was suspended over the cylinder which held the siliceous earth, was covered with the white powder, but no appearance of it was seen on the other. The experiment was repeated by Mr Meyer with the same result, but the white crust did not appear till after a night's standing.

12. A drachm of fluor, mixed with two of oil of vitriol, afforded, after a distillation of two hours, a thin film of lead on the surface of the water in the receiver, but no siliceous earth. The same mixture was afterwards distilled with the use only of a glass receiver instead of a lead one. In the beginning of the distillation a small spot appeared under the neck of the retort, and the neck itself was covered with white powder, but it soon disappeared; and though the empty part of the receiver was corroded, yet no more than half a grain of earth was procured.

These experiments so clearly point out the origin of the siliceous crust on the surface of the fluor acid, that its existence as a distinct acid is now universally allowed, even by those who formerly contended for its being only the vitriolic or some other acid disguised.—

850 Mr Wenzel's experiments in a leaden retort.

Experiments of a similar kind were made by Mr Wenzel, who performed his distillation in a leaden retort, furnished with a glass receiver. The water was covered with a variegated crust, and yielded a gelatinous precipitate with fixed alkali. On examining the receiver, he found its internal surface corroded, so that it appeared as if it had been rubbed with coarse sand. By substituting a leaden receiver, however, instead of a glass one, he obtained the acid entirely free from siliceous matter, and containing only a small quantity of iron and aluminous earth.

2d 850 Fluor acid procurable by nitrous, muriatic, and phosphoric acid.

The fluor acid may also be procured by the nitrous, muriatic, and phosphoric acids.—Mr Scheele distilled one part of the mineral with two of concentrated nitrous acid. One part went over into the receiver along with the fluor acid, and a thick crust was formed on the water of the receiver. The mass remaining in the retort was calcareous earth saturated with nitrous acid.

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With an equal quantity of marine acid, that of fluor passed over into the receiver with a large quantity of the muriatic; the internal surface of the receiver, as well as of the water contained in it, being covered with a white crust. The residuum was fixed sal ammoniac.

Phosphoric acid digested with powdered fluor, dissolved a good deal of it; and on distilling this solution, the fluor acid went over together with the watery particles of the mixture; the remaining mass in the retort had the properties of the ashes of bones.

3d 850 Appearance and properties of fluor acid.

The fluor acid procured in any of these ways is not distinguishable by the smell from that of sea-salt: in some cases it acts as muriatic acid, in others like that of tartar; but in most cases it shows properties peculiar to itself.

4th 850 Combined with fixed alkali.

With fixed alkali the fluor acid forms a gelatinous and almost insipid matter, which refuses to crystallize. By evaporation a saline mass was obtained, which was in weight only the sixth part of the fixed alkali dissolved; did not change the colour of syrup of violets, but precipitated lime water, and likewise the solutions of gypsum and Epsom salt. With mineral alkali the same phenomena were produced as with the vegetable.

851 With volatile alkali.

Volatile alkali with fluor acid formed likewise a jelly, which when separated from the liquor appeared to be siliceous earth. The clear liquid tasted like vitriolic ammoniac, and shot into very small crystals, which by sublimation yielded first a volatile alkali, and then a kind of acid sal ammoniac. By distillation with chalk and water, all the volatile alkali quickly came over. Lime water instantly threw down a regenerated fluor, which was the case also with solutions of lime in the nitrous and muriatic acids.—Solution of silver let fall a powder, which, before the blow-pipe, resumed its metallic form, the acid being dissipated, and forming a white spot on the charcoal round the reduced silver. Solution of quicksilver in nitrous acid was precipitated, and the powder was entirely volatile in the fire; but a solution of corrosive sublimate remained unchanged. Lead was totally precipitated from nitrous acid; and a solution of Epsom salt was rendered turbid. Oil of vitriol produced a fluor acid by distillation, which formed at the same time a thick crust on the water of the receiver. The regenerated fluor procured either by means of lime water or solutions of the earth in acids, was decomposed by fixed, but not by volatile alkali.

852 With earths.

With lime, magnesia, and earth of alum, this acid became gelatinous. Part of the two last were dissolved.

853 With metal.

Gold was not touched by the fluor acid either alone or mixed with that of nitre. Silver, in its metallic state, underwent no change. Its calx, precipitated by an alkali, was partly dissolved; but the remainder formed an insoluble mass at the bottom Vitriolic acid expelled the fluor acid in its usual form. Quicksilver was not dissolved, but its calx precipitated from the nitrous solution was partially so. The remaining insoluble part of the calx united with the acid, and formed a white powder, from which the fluor acid was expelled by the vitriolic. The same powder formed, by means of the blow-pipe, a yellowish glass; which, however, evaporated by degrees, leaving a small globule of fixed glass behind. Lead was not dissolved, but the acid formed a sweet solution with its calx; from whence the latter could be precipitated by the acids of vitriol, and sea-salt, as also by sal ammoniac. On digesting a quantity of acid with calx of lead, which had been previously digested in the same, a spontaneous precipitation took place. The precipitate melted easily before the blow-pipe, and ran into metal; but part of the glass remained fixed in the fire. Copper was partially dissolved, as appeared by the blue colour assumed by the liquid on the addition of volatile alkali. The calx of copper was easily soluble; and the liquor, though gelatinous, yielded blue crystals, partly of a cubic and partly of an oblong form, from which the acid could not be separated but by heat. Iron was violently attacked, and gave out inflammable vapours during the solution. The liquor refused to crystallize; but, by evaporation, congealed into an hard mass after the moisture was dissipated; and from this mass the fluor acid might be expelled as usual by oil of vitriol. The same effect was also produced by heat alone; the acid rising in vapours, and leaving a red ochre behind. Calx of iron was also dissolved, and the solution tasted like alum; but it could not be reduced to crystals. Tin, bismuth, and regulus of cobalt, were not attacked in their metallic state; but the calces of all of them were soluble. Regulus of antimony and powdered antimony were not sensibly acted upon. Zinc produced the same effects as iron, excepting that the solution seemed more inclined to crystallize.

854 Glass corroded by this acid, as well as the salt formed by its combination with volatile alkali.

The most remarkable property of this acid, however, is its readily dissolving glass and carrying it off in the form of vapour. This singular property belongs not only to the pure acid, but also to the ammoniacal salt formed by combining it with the volatile alkali. Mr Wiegleb informs us, that on evaporating to dryness, in a cup of Misnia porcelain, a solution of this kind of ammoniac, which by its smell showed an excess of volatile alkali, the glazing of the inside was entirely corroded, and the bottom left as rough as a file. During the evaporation the cup was covered with white paper, which when dry appeared full of small crystals of an acid taste, easily distinguishable by the naked eye. These, as well as the ammoniacal salt, powerfully attracted the moisture of the air.

855 It is very difficult to be kept.

This property of the fluor acid renders it extremely difficult to be kept. Mr Meyer informs us, that having kept some upwards of a year in a glass phial, it corroded the glass in many points surrounded with concentric circles, depositing a powder which adhered to the bottom. He is of opinion that golden vessels would be most proper for keeping this acid, as also for making experiments on the fluor itself. A phial covered in the inside with wax and oil has been recommended for the same purpose.

856 Golden vessels most proper for this purpose.

857 Dr Priestley's experiments on converting this acid into a kind of air.

This acid, as well as those of vitriol, nitre, and sea-salt, has been exhibited by Dr Priestley in an aerial form. Having put some pounded spar into a phial, and poured oil of vitriol upon it, adopting at the same time the usual apparatus for obtaining air, he observed that a permanent cloud was formed by the vapour issuing out from the mouth of the tube, which he attributed to the attachment of the acid to the aqueous moisture of the atmosphere. The moment that water came

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came in contact with this air, its ſurface became opaque and white by a ſtony film, which retarded the aſcent of the water, till the air inſinuating itſelf through the pores and cracks of the cruſt, the water neceſſarily roſe as the air diminiſhed; and breaking the cruſt, preſented a new ſurface to the air, which was immediately covered with another cruſt. Thus one ſtony incruſtation was formed after another till every particle of the air was united to the water; and the different films being collected and dried, formed a white powdery ſubſtance, generally a little acid to the taſte; but when waſhed in much pure water, perfectly inſipid. The property of corroding glaſs he found to belong to the fluor acid air only when hot. From ſome other experiments he concluded, that the fluor acid air was the ſame with what he had formerly obtained from vitriolic acid: but the experiments made ſince that time by various chemiſts, have now convinced him that it is an acid of a nature entirely different from all others.

2d 857 Method of engraving on glaſs.

By means of the fluor acid, a new art has been diſcovered, viz. that of engraving upon glaſs. For this purpoſe a looking-glaſs plate is to be covered with melted wax or maſtic; and when the coating becomes hard, it is to be engraved upon by a very ſharp-pointed needle or other inſtrument of that kind. A mixture of oil of vitriol and fluor acid are then to be put upon the plate, and the whole covered with an inverted China veſſel, to prevent the evaporation of the fluor acid. In two days the glaſs plate may be cleared of its coating, when all the traces of the needle will be found upon it.

### § 5. *Of the* Sal Sedativus, *or Acid of Borax.*

858 Found in a mineral in Germany, &c.

This is a ſaline ſubſtance of a very ſingular nature, and till lately found no where but in borax itſelf. Its origin in different parts of the world is related under the article Borax: but ſince that article was printed, we have accounts of its being diſcovered in a mineral of a peculiar kind found at Lunenburg near Hartz. This is frequently tranſparent, but ſometimes alſo a little opaque, and ſtrikes fire ſlightly with ſteel. It has hitherto been found only in ſmall cryſtals inveloped in a gypſeous matter. Theſe generally affect the cubical form, though they are ſometimes irregular, and from the truncatures frequently appear to be of different kinds. One of them had fourteen faces, ſix ſmall ſquare planes, and eight hexahedral; though all theſe are modifications of cubes. Mr Weſtrumb analized it with ſome difficulty; but at laſt found that 100 parts of the mineral contained 60 of ſedative ſalt, ten of magneſia, and ten of calcareous earth; of clay and flint five parts, ſometimes ten of iron, though frequently but five. The ſame acid has alſo been diſcovered in Peru, and a little in Hungary from an analyſis of petroleum. This bitumen ariſes from a rock between Pecklenicza and Moſcowina. It ſeems at firſt to be white, but ſoon grows black by expoſure to the air. It was analyſed by profeſſor Winterl, who found it to contain a tranſparent oil in a butyraceous form, and a true ſedative ſalt, united with the oil by means of an exceſs of phlogiſton. The ſedative ſalt was firſt diſcovered by Bechr, and afterwards more accurately deſcribed by Homberg; but its nature was at firſt very much miſunderſtood, being named the *narcotic ſalt of vitriol*, on account of the vitriolic acid uſed in ſeparating it from the borax. From this it is ſeparable either by ſublimation or cryſtallization. The method by ſublimation is that recommended by Homberg.

2d 858 How prepared from borax.

His proceſs conſiſts in mixing green vitriol with borax, diſſolving them in water, filtering the ſolution, and evaporating till a pellicle appears: the liquor is then to be put into a ſmall glaſs alembic, and the ſublimation promoted till only a dry matter remains in the cucurbit. During this operation, the liquor paſſes into the receiver; but the internal ſurface of the capital is covered with a ſaline matter forming very ſmall, thin, laminated cryſtals, very ſhining, and very light. This is the ſedative ſalt. The capital is then to be unluted, and the adhering ſalt ſwept off with a feather; the part of the liquor which paſſed laſt into the receiver, is to be poured on the dry matter in the cucurbit; and a new ſublimation is to be promoted as before, by diſtilling till the matter in the cucurbit is dry. Theſe operations are to be frequently repeated in the ſame manner, till no more ſedative ſalt can be obtained.

To obtain the ſedative ſalt by cryſtallization, borax is to be diſſolved in hot water; and to this ſolution any one of the three mineral acids is to be gradually added, by a little at a time, till the liquor be ſaturated, and even have an exceſs of acid, according to Mr Beaumé's proceſs. The liquor is then to be left in a cold place; and a great number of ſmall, ſhining, laminated cryſtals will be formed; theſe muſt be waſhed with a little very cold water, and drained upon brown paper. The ſedative ſalt obtained by this proceſs is ſomewhat denſer than that obtained by ſublimation; the latter being ſo light that 72 grains are ſufficient to fill a large phial.

859 Fixed in the fire.

Sedative ſalt, though thus capable of being once ſublimed, is not, however, volatile; for it ariſes only by means of the water of its cryſtallization; and when it has once loſt its water by drying, it cannot be raiſed into vapours by the moſt violent fire, but remains fixed, and melts into a vitreous matter like borax itſelf. This glaſs is ſoluble in water; and then becomes ſedative ſalt again. A great quantity of water is required to diſſolve the ſedative ſalt, and much more of cold than of boiling water; whence it is cryſtallizable by cold, as it alſo is by evaporation; a ſingular property, which ſcarce belongs to any other known ſalt.

860 Its properties.

This ſubſtance has not an *acid*, but a ſomewhat bitteriſh, taſte, accompanied with a ſlight impreſſion of coolneſs. It nevertheleſs unites with alkaline ſalts as acids do, and forms with them neutral ſalts. It is ſoluble in ſpirit of wine, to which it communicates the property of burning with a green flame. It makes no change on the blue colour of vegetables, as other acids do. It expels the other acids from their baſes, when diſtilled with a ſtrong heat; though theſe are all capable of expelling it in the cold, the acid of vinegar not excepted.

861 Mr Bourdelin's experiments.

The compoſition of ſedative ſalt is very much unknown, as no means ſufficient for its decompoſition have hitherto been found out. Mr Bourdelin, who made many experiments on this ſalt, found that it was unalterable by treatment with inflammable matters, with ſulphur, with mineral acids diſengaged, or united with metallic ſubſtances, and with ſpirit of wine. He

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could only perceive some marks of an inflammable matter, and a little marine acid. The former discovered itself by its communicating a sulphureous smell to the vitriolic acid employed; and the latter by a white precipitate formed in a solution of mercury in the nitrous acid, by the liquor which came over on distilling the salt with powdered charcoal.

862 Mr Cadet's experiments.

Mr Cadet, in the Memoirs of the Royal Academy of Sciences for 1766, has given an account of some experiments made by him on borax and its acid: from which he infers (1). That the acid contained in borax itself is the marine, and not sedative, salt. (2.) That it is the marine, he proves by having made a corrosive sublimate with this acid and *mercurius precipitatus per se*. That sedative salt does not enter the composition of borax itself, he proves, by the impossibility of recomposing borax from uniting the sedative salt with fossile alkali. The salt so produced, he owns, is very like borax, but unfit for the purposes of soldering metals as borax is. He therefore thinks, that, in the decomposition of borax, the principles of the salt are somewhat changed, by the addition of that acid which extricates the sedative salt; and that this salt is composed of the marine acid originally existing in the borax, of the vitriolic acid employed in the operation, and of a vitrescible earth. (If this is true, then sedative salt either cannot be procured by any other acid than the vitriolic, or it must have different properties according to the acid which procures it.) The vitrescible earth, he says, is that which separates from borax during its solution in water, and which abounds more in the unrefined than refined borax, and which he thinks consists of a calx of copper, having obtained a regulus of copper from it. As he has never been able, however, to compose borax by the union of these ingredients, his experiments are by no means decisive. Mr Beaumé has asserted that it is always produced by rancid oils; but Dr Black thinks his proofs by no means satisfactory.

Sedative Salt COMBINED,

I. *With Vegetable Alkali.* This salt forms a compound very much resembling borax itself in quality; but in what respects it differs from, or how far it is applicable to, the purposes of borax, hath not yet been determined.

863 Borax.

II. *With Mineral Alkali.* This salt has generally been thought to recompose borax: and though Mr Cadet has denied this, yet as his experiments are hitherto imperfect and unsupported, we shall here give the history of that salt, as far as it is yet known.

This salt is prepared in the East Indies. It is said, that from certain hills in these countries there runs a green saline liquor, which is received in pits lined with clay, and suffered to evaporate with the sun's heat; that a bluish mud which the liquor brings along with it is frequently stirred up, and a bituminous mather, which floats upon the surface, taken off; that when the whole is reduced to a thick consistence, some melted fat is mixed, the matter covered with vegetable substances and a thin coat of clay; and that when the salt has crystallized, it is separated from the earth by a sieve. In the same countries is found native the mineral alkali in considerable quantity; sometimes tolerably pure, at other times blended with heterogeneous matters of various kinds. This alkali appears to exist in borax, as a Glauber's salt may be formed from a combination of borax with vitriolic acid. For a further account See BORAX.

864 Refined.

Borax, when imported from the East Indies, consists of small, yellow, and glutinous crystals. It is refined, some say, by dissolving it in lime-water; others, in alkaline lixivia, or in a lixivium of caustic alkali; and by others, in alum-water. Refined borax consists of large eight-sided crystals, each of which is composed of small, soft, and bitterish scales. It has been said that crystals of this size can by no means be obtained by dissolving unrefined borax in common water; that the crystals obtained in this way are extremely small, and differ considerably from the refined borax of the shops; insomuch that Cramer calls the large crystals, not a purified, but an adulterated borax. When dissolved in lime-water, the borax shoots into larger crystals; and largest of all, when the vessel is covered, and a gentle warmth continued during the crystallization. All this, however, is denied by Dr Black; who says, that in order to accomplish the purification, we have only to dissolve the impure borax in hot water; to separate the impurities by filtration, after which the salt shoots into the crystals we commonly see. During the dissolution, borax appears glutinous, and adheres in part to the bottom of the vessel. From this glutinous quality, peculiar to borax among the salts, it is used by dyers for giving a gloss to silks.

865 Its properties.

All acids dissolve borax slowly, and without effervescence. It precipitates from them most, but not all, metallic substances; along with which a considerable part of the borax is generally deposited. It does not absorb the marine acid of luna cornea, or of mercury sublimate. It melts upon the surface of the former without uniting, and suffers the latter to rise unchanged: the borax in both cases becomes coloured; in the first, milky with red streaks; in the latter, amethyst or purple. Mixed with sal ammoniac, it extricates the volatile alkali, and retains the acid; but mixed with a combination of the marine acid with calcareous earths, it unites with the earth, and extricates the acid. It extricates the acid of nitre without seeming to unite with the alkaline basis of that salt; nor does it mingle in fusion with the common fixed alkaline salts, the borax flowing distinct upon their surface. A mixture of borax with twice its weight of tartar, dissolves in one sixth of the quantity of water that would be necessary to dissolve them separately: the liquor yields, on inspissation, a viscous, tenacious mass like glue; which refuses to crystallize, and which deliquates in the air. Borax affords likewise a glutinous compound with the other acids, except the vitriolic; whence this last is generally preferred for making the sedative salt. It proves most glutinous with the vegetable, and least with the marine. With oils, both expressed and distilled, it forms a milky, semi-saponaceous compound. It partially dissolves in spirit of wine. In conjunction with any acid, it tinges the flame of burning matters green; the precipitate thrown down by it from metallic solutions has this effect. It does not deflagrate with nitre. Fused with inflammable matters, it yields nothing sulphureous, as those salts do which

Acetous acid and its combinations.

which contain vitriolic acid. By repeatedly moiſtening it when conſiderably heated, it may be entirely ſublimed.

Borax retains a good quantity of water in its cryſtals; by which it melts and ſwells up in a heat inſufficient to vitrify it. It is then ſpongy and light, like calcined alum; but, on increaſing the fire, it flows like water.

### § 6. *Of the* Acetous *Acid and its Combinations.*

867 How procured.

This acid is plentifully obtained from all vinous liquors, by a fermentation of a particular kind, (ſee Fermentation, and Vinegar.) It appears firſt in the form of an acid liquor, more or leſs deeply coloured, as the vinegar is more or leſs pure. By diſtillation in a common copper-ſtill, with a pewter head and worm, this acid may be ſeparated from many of its oily and impure parts. Diſtilled vinegar is a purer but not a ſtronger acid than the vinegar itſelf; for the acid is originally leſs volatile than water, though, by certain operations, it becomes more ſo. After vinegar has been diſtilled to about $\frac{1}{16}$ of its original bulk, it is ſtill very acid, but thick and black. This matter continues to yield, by diſtillation, a ſtrong acid ſpirit, but tainted with an empyreumatic oil. If the diſtillation is continued, a thick black oil continues to come over; and at laſt ſome volatile alkali, as in the diſtillation of animal ſubſtances. The caput mortuum left in the diſtilling veſſel, being calcined in an open fire, and afterwards lixiviated, yields ſome fixed alkaline ſalt.

Acetous Acid combined,

868 Sal diureticus.

I. *With Vegetable Alkali.* The produce of this combination is the *terra foliata tartari*, or ſal diureticus of the ſhops; but to prepare this ſalt of a fine white flaky appearance, which is neceſſary for ſalt, is a matter of ſome difficulty. The beſt method of performing this operation is, after having ſaturated the alkali with the vinegar, which requires about 15 parts of common diſtilled vinegar to one of alkali, to evaporate the liquor to dryneſs; then melt the ſaline maſs which remains with a gentle heat; after which it is to be diſſolved in water, then filtered, and again evaporated to dryneſs. If it is now diſſolved in ſpirit of wine, and the liquid abſtracted by diſtillation, the remaining maſs being melted a ſecond time, will, on cooling, have the flaky appearance deſired.

A good deal of caution is neceſſary in the firſt melting; for the acetous acid is eaſily diſſipable, even when combined with fixed alkali, by fire. It is proper, therefore, that, when the ſalt is melted, a little ſhould be occaſionally taken out, and put into water; and when it readily parts with its blackneſs to the water, muſt then be removed from the fire. The ſalt, when made, has a very ſtrong attraction for water, inſomuch that it is not eaſily preſerved, even when put into glaſs bottles. To keep it from deliquating, Dr Black, therefore, recommends the corks to be covered with ſome bituminous matter; otherwiſe they would tranſmit moiſture enough to make the ſalt deliquate.

869 Acetous acid with foſſile alkali.

II. *With Foſſile Alkali.* This alkali, combined with the acetous acid, forms a ſalt whoſe properties are not well known. Dr Lewis affirms, that it is nearly ſimilar to the terra foliata tartari. The author of the Chemical Dictionary, again, maintains it to be quite different: particularly that it cryſtallizes well, and is not deliqueſcent in the air; whereas the former cannot be cryſtallized; and even when obtained in a dry form, unleſs great care is taken to exclude the air, will preſently deliquate.

870 Vegetable ammoniac.

III. *With Volatile Alkali.* This combination produces a ſalt ſo exceedingly deliqueſcent, that it cannot be procured in a dry form without the greateſt difficulty. In a liquid ſtate, it is well known in medicine, as a ſudorific, by the name of *ſpiritus mindereri.* It may, however, be procured in a dry form, by mixing equal parts of vitriolic ſal ammoniac and terra foliata tartari, and ſubliming the mixture with a very gentle heat. When the ſalt is once procured, the utmoſt care is requiſite to preſerve it from the air.

871 Anomalous ſalts.

IV. *With Earths.* Combinations of this kind are but little known. With the calcareous and argillaceous earths compounds of an aſtringent nature are formed. According to the author of the Chemical Dictionary, the ſalt reſulting from a combination of vinegar with calcareous earth eaſily cryſtallizes, and does not deliquate. With magneſia the acetous acid does not cryſtallize; but, when inſpiſſated, forms a tough maſs, of which two drachms, or two and a half, are a briſk purgative.

872 Diſtilled verdegris.

V. *With Copper.* Upon this metal the acid of vinegar does not act briſkly, until it is partly at leaſt calcined. If the copper is previouſly diſſolved in a mineral acid, and then precipitated, the calx will be readily diſſolved by the acetous acid. The ſolution is of a green colour, and beautiful green cryſtals may be obtained from it. The ſolution, however, is much more eaſily effected, by employing verdegris, which is copper already united with a kind of acetous or tartareous acid, and very readily diſſolves in vinegar. The cryſtals obtained by this proceſs are uſed in painting, under the name of *diſtilled verdegris.*

The moſt ready, and in all probability the cheapeſt, method of preparing the cryſtals of verdegris is that propoſed by Mr Wenzel, by mixing together the ſolutions of ſugar of lead and blue vitriol, when an exchange of baſes takes place; the lead being inſtantly precipitated by the vitriolic acid, and the acetous acid uniting with the copper. From 15 ounces and two drachms of ſugar of lead with twelve ounces of blue vitriol, five ounces of the cryſtals were obtained. The precipitate of lead, though waſhed ſeveral times with water, never loſt its green colour. It may either be uſed, he ſays, in this ſtate, as a green pigment, or it may be made perfectly white by digeſtion in dilute nitrous acid.

873 Iron liquor for printing cloth.

VI. *With Iron.* Vinegar acts very readily upon iron, and diſſolves it into a very brown and almoſt black liquor, which does not eaſily cryſtallize, but, if inſpiſſated, runs per deliquium. This liquor is employed in the printing of linens, calicoes, &c. being found to ſtrike a finer black with madder, and to injure the cloth leſs, than ſolutions of iron in the other acids.

874 Lead.

VII. *With Lead.* The acetous acid diſſolves lead in its metallic ſtate very ſparingly; but if the metal is calcined, it acts upon it very ſtrongly. Even after lead is melted into glaſs, the acetous acid will receive a ſtrong impregnation from it; and hence it is dangerous to

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to put vinegar into such earthen vessels as are glazed with lead. In the metallic state, only a drachm of lead can be dissolved in eight ounces of distilled vinegar.

875 Cerufs.

If lead is exposed to the vapours of warm vinegar, it is corroded into a kind of calx, which is used in great quantities in painting, and is known by the name of *cerufs* or *white lead*. The preparation of this pigment has become a distinct trade, and is practised in some places in Britain where lead is procurable at the lowest price. The process for making cerufs is thus given by the author of the Chemical Dictionary.

"To make cerufs, leaden plates rolled spirally, so that the space of an inch shall be left between each circumvolution, must be placed vertically in earthen pots of a proper size, containing some good vinegar. These leaden rolls ought to be so supported in the pots that they do not touch the vinegar, but that the acid vapour may circulate freely betwixt the circumvolutions. The pots are to be covered, and placed in a bed of dung, or in a sand-bath, by which a gentle heat may be applied. The acid of vinegar being thus reduced into vapour, easily attaches itself to the surface of these plates, penetrates them, and is impregnated with the metal, which it reduces to a beautiful white powder, called *cerufs*. When a sufficient quantity of it is collected on the plates, the rolls are taken out of the pots, and unfolded; the cerufs is then taken off, and they are again rolled up, that the operation may be repeated.

"In this operation, the acid being overcharged with lead, this metal is not properly in a saline state; hence cerufs is not in crystals, nor is soluble in water: but a saline property would render it unfit for painting, in which it is chiefly employed."

876 Observations on the process for cerufs.

Though this process may in general be just, yet there are certainly some particulars necessary to make cerufs of a proper colour, which this author has omitted; for though we have carefully treated thin plates of lead in the manner he directs, yet the calx always turned out of a dirty grey colour. It is probable, therefore, that after the lead has been corroded by the steam of vinegar, it may be washed with water slightly impregnated with the vitriolic and nitrous acids.

This preparation is the only white hitherto found fit for painting in oil: but the discovery of another would be very desirable, not only from the faults of cerufs as a paint, but also from its injuring the health of persons employed in its manufacture, by affecting them with a severe colic; which lead, and all its preparations, frequently occasion.

877 Sugar of lead.

If distilled vinegar is poured on white lead, it will dissolve it in much greater quantity than either the lead in its metallic form, or any of its calces. This solution filtered and evaporated, shoots into small crystals of an austere sweetish taste called *sugar of lead*. These are used in dyeing, and externally in medicines. They have been even given internally for spitting of blood. This they will very certainly cure; but at the same time they as certainly kill the patient by bringing on other diseases. If these crystals are repeatedly dissolved in fresh acids, and the solutions evaporated, an oily kind of substance will at last be obtained, which can scarcely be dried.

From all the metallic combinations of the acetous acid, it may be recovered in an exceedingly concentrated form, by simple distillation, sugar of lead only excepted. If this substance is distilled in a retort with a strong heat, it hath been said that an inflammable spirit, and not an acid comes over; but this is denied by Dr Black.

878 Inflammable spirit from sugar of lead.

879 Tin.

VIII. *With Tin.* The combination of acetous acid with tin is so little known, that many have doubted whether distilled vinegar is capable of dissolving tin or not.

880 Dr Lewis's experiments concerning the solubility of tin.

Dr Lewis observes, "That plates of pure tin put into common vinegar begun in a few hours to be corroded, without the application of heat. By degrees a portion of the metal was taken up by the acid, but did not seem to be perfectly dissolved, the liquor appearing quite opaque and turbid, and depositing great part of the corroded tin to the bottom, in a whitish powder. A part of the tin, if not truly dissolved, is exquisitely divided in the liquor; for, after standing many days and after passing through a filter, so much remained suspended as to give a whitishness and opacity to the fluid. Acid juices of fruits, substituted to the vinegar, exhibited the same phenomena. These experiments are not fully conclusive for the real solubility of tin in these acids, with regard to the purposes for which chemists have wanted such a solution: but they prove what is more important; that tin, or tinned vessels, however pure the tin be, will give a metallic impregnation to light vegetable acids suffered to stand in them for a few hours."

With regard to other metallic substances, neither the degree of attraction which the acetous acid has for them, nor the nature of the compounds formed by the union of it with such substances, are known; only, that as much of the reguline part of antimony is dissolved in this acid as to give it a violent emetic quality. See *Regulus of Aatimony*.

## Concentration of the *Acetous Acid*.

881 Concentrated vinegar.

Common vinegar, as any other weak acid, may be advantageously concentrated by frost; as also may its spirit or the distilled vinegar of the shops: but as the cold, in this country, is seldom or never so intense as to freeze vinegar, this method of concentration cannot be made use of here. If distilled vinegar be set in a water-bath, the most aqueous part will arise, and leave the more concentrated acid behind. This method, however, is tedious, and no great degree of concentration can be produced, even when the operation is carried to its utmost length. A much more concentrated acid may be obtained by distilling in a retort the crystals of copper, mentioned (n° 872) under the name of *distilled verdegris*. A very strong acid may thus be obtained, which has a very pungent smell, almost as suffocating as volatile sulphureous acid. The Count de Lauraguais discovered that this spirit, if heated in a wide-mouthed pan, would take fire on the contact of flaming substances, and burn entirely away, like spirit of wine, without any residuum.

882 Salt of vinegar.

The same nobleman also observed, that this spirit, when well concentrated, easily crystallizes without addition.

This

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This may seem to be the most proper method of obtaining the acetous acid in its greatest degree of strength and purity: but as the process requires a very strong heat to be used towards the end of the operation, it is probable that part of the acetous acid may be by that means entirely decomposed. It would seem preferable, therefore, to decompose pure terra foliata tartari by means of the vitriolic acid, in the same manner as nitre or sea-salt are decomposed for obtaining their acids. In this case, indeed, the acetous acid might be a little mixed with the vitriolic; but that could easily be separated by a second distillation. A still better method of preparing the acid seems to be by distilling sugar of lead with oil of vitriol. The proportion used by M. Lorenzen of Copenhagen, is three ounces of vitriolic acid to eight of the sugar of lead. Mr Dollfuss recommends two parts of sugar of lead to one of vitriolic acid.

883 Dr Priestley's experiments.

Dr Priestley, who gives us several experiments on the vegetable acid when reduced to the form of air, mentions his being easily able to expel it from some exceedingly strong concentrated vinegar, by means of heat alone. This seems somewhat contrary to the count de Lauraguais's observation of the disposition of the *spirit of verdegris*, as it is commonly called, to crystallize: but a still greater difference is, that the vegetable acid air extinguished a candle, when according to the Count's observation, it ought to have been inflammable. The most curious property observed by Dr Priestley is, that the vegetable acid air being imbibed by oil olive, the oil was rendered less viscid, and clearer, *almost like an essential oil*. This is an useful hint; and, if pursued, might lead to important discoveries.

### Acetous acid combined with *Inflammable Matter*.

884 Vegetable ether.

The only method yet known, of combining acetous acid with the principle of inflammability, is by mixing together equal parts of the strongly concentrated acid called *spirit of verdegris*, and spirit of wine. The result is, a new kind of *ether*, similar to the vitriolic, nitrous, and marine. This ether, however, retains some of the acidity and peculiar smell of the vinegar. By rectification with fixed alkali, it may be freed from this acidity, and then smells more like true ether, but still retaining something of the smell, not of the acid, but the inflammable part of the vinegar.

In this process a greater quantity of ether is obtained than by employing the vitriolic acid: which shows that the vegetable acid is essentially fitter to produce ether than the vitriolic. For making the acetous ether readily, Mr Dollfuss recommends eight ounces of sugar of lead dried by a very gentle heat, until it loses the water of crystallization, when it will weigh five ounces and six drachms. It is then to be put into a glass retort and a mixture of five ounces of vitriolic acid, with eight of spirit of wine, poured upon it, and the whole distilled with a very gentle fire. The first ounce that passes over will be dulcified acetous acid, the next almost all ether, and the third ether in its purest state.

An ether may also be obtained from vinegar of wood. To make it, the most concentrated acid of this kind is to be made use of. For this purpose an empyreumatic acid must first be distilled from beech-wood, and then rectified by a second distillation. Three pounds of this require for their saturation five ounces of purified alkali, which by evaporation and fusion affords three ounces and a quarter of terra foliata tartari. From this, one ounce six drachms of concentrated acid are obtained; and this, on being mixed with an equal quantity of alcohol, yields two ounces one drachm and a half of genuine ether.

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## § 7. *Of the Acid of* TARTAR.

885 Tartar.

TARTAR is a substance thrown off from wine, after it is put into casks to depurate. The more tartar that is separated, the more smooth and palatable the wine is. This substance forms a thick hard crust on the sides of the casks: and, as part of the fine dregs of the wine adhere to it, the tartar of the white wines is of a greyish white colour, called *white tartar*; and that of red wine has a red colour, and is called *red tartar*.

886 Cream of tartar.

When separated from the casks on which it is formed, tartar is mixed with much heterogeneous matter; from which, for the purposes of medicine and chemistry, it requires to be purified. This purification is performed at Montpelier; and consists first in boiling the tartar in water, filtrating the solution, and allowing the salt to crystallize, which it very soon does; as tartar requires nearly twenty times its weight of water to dissolve it.

The crystals of tartar obtained by this operation are far from being perfectly pure; and therefore they are again boiled in water, with an addition of clay, which absorbs the colouring matter; and thus, on a second crystallization, a very pure and white salt is obtained. These crystals are called *cream*, or *crystals of tartar*; and are commonly sold under these names.

Dr Black observes, that in the purification of tartar, it is necessary to add some earthy substances, in order to absorb or carry down the colour. Macquer thinks that these substances unite in part with the tartar, and render it more soluble, but they have little disposition to unite with acids; they are the purer kinds of clay, and promote the complete deposition of its impurities; so that in the management of wines it is necessary to add certain powdery substances which have some weight, and fall to the bottom readily; and which, in falling, carry down a number of particles that would otherwise float in the liquor for a long time, being so light that they could hardly be made to subside; but the particles of clay adhering to them increase their gravity; and probably it answers the same purpose in the refinement of tartar.

### To obtain the pure Acid of *Tartar*.

887 Scheele's analysis of cream of tartar.

For a long time the cream or crystals of tartar were considered as the purest acid which could be obtained from this substance; but, in the year 1770, an analysis of tartar was published in the Swedish transactions, by Mr Scheele. His method of decomposing the salt was, to dissolve it in a sufficient quantity of boiling water, then to add chalk in fine powder till the effervescence ceased. A copious precipitation ensued; and the remaining liquor being evaporated;

Acid of tartar and its combinations.

porated, afforded a soluble tartar. This proved that cream of tartar is not, as was commonly supposed, an acid of a peculiar kind, joined with a great deal of earthy impurities; but really a compound salt, containing an alkali joined with an acid; and that the alkali produced from burnt tartar is not generated in the fire, but pre-existent in the salt.

The whole sediment contained in this experiment, is the calcareous earth combined with the acid of tartar, which may justly be called *selenites tartareus*. If some diluted vitriolic acid is poured upon this selenites tartareus, the vitriolic acid expels the acid of tartar, forming a true selenite with the earth, while the liquor contains the pure acid of tartar. By inspissation this acid may be made stronger, and even formed into small white crystals, which do not deliquate in the air. A particular species of tartar extracted from sorrel hath been sold for taking spots out of clothes, under the name of *essential salt of lemons*, and which is now discovered to be the same with the acid of sugar.

888 Essential sals of lemon.

This experiment was soon after confirmed by Dr Black; who farther observed, that if quicklime was used instead of chalk, the whole acid would be absorbed by the lime, and the remaining liquor, instead of being a solution of soluble tartar, would be a caustic lixivium. The most ready method, however, of procuring the pure acid of tartar seems to be that recommended by Mr Schiller in the Chemical Annals for 1787. One pound of cream of tartar is to be boiled in five or six pounds of water, and a quartar of a pound of oil of vitriol added by little and little, by which means a perfect solution will be obtained. By continuing the boiling, all the vitriolated tartar is precipitated. When the liquor is evaporated to one half, it must be filtered; and if, on the renewal of the boiling, any thing farther is precipitated, the filtration is to be repeated. The clear liquor is then to be reduced to the consistence of a syrup, and set in a temperate, or rather a warm place, when very fine crystals will be formed, and as much acid obtained as is equal in weight to half the cream of tartar employed. If too small a quantity of vitriolic acid has been employed, the undecomposed cream of tartar falls along with the vitriolated tartar.

### Acid of Tartar COMBINED,

889 Soluble tartar.

I. *With Vegtable Alkali.* If the pure acid of tartar be combined with this alkali to the point of saturation, a neutral salt is produced, which deliquates in the air, and is not easily crystallized, unless the liquor be kept warm, and likewise be somewhat alkaline. This salt, called *soluble tartar*, is used in medicine as a purgative; but as its deliquesence does not admit of its being kept in a crystalline form, it is always sold in powder. Hence those who prepare soluble tartar, take no further trouble than merely to rub one part of fixed alkaline salt with three of cream of tartar, which renders the compound sufficiently neutral, and answers all the purposes of medicine. Dr Black informs us, that in medical prescriptions, where soluble tartar is ordered as a purgative along with a decoction of tamarinds, the acid of the latter will decompose the soluble tartar, and thus the prescription may perhaps be rendered ineffectual. The saline mixture used in fevers is nothing but a tartarus solubilis in solution.

According to Mr Scheele, cream of tartar may be recomposed from the pure acid and alkali in the following manner: "Upon fixed vegetable alkali pour a solution of the acid of tartar. Continue this till the effervescence is over; the fluid will then be transparent; but if more of the acid is added, it will become turbid and white, and small crystals like white sand will be formed in it. These crystals are a perfect cream of tartar.

890 Regenerated cream of tartar.

Upon these principles, another method of decomposing cream of tartar might be tried; namely, adding to it as much oil of vitriol as would saturate the alkali, then dissolving and crystallizing the salt: but, by this method, there would be danger of the acid being adulterated with vitriolic tartar.

891 Siegnette's or Rochelle salt.

II. *With Fossile Alkali.* The salt produced from an union of cream of tartar with fossile alkali, has been long known under the names of *Siegnette's salt, sal Rupellensis*, or *Rochelle salt;* but as the cream of tartar is now discovered to be not a pure acid, but adulterated with a portion of soluble tartar, possibly some differences might be observed if the pure acid was used.

This salt was first invented and brought into vogue by one Seignette, an apothecary at Rochelle, who kept the composition a secret as long as he could. Messrs Boylduc and Geoffroy afterwards discovered and published its composition.

To prepare this salt, crystals of mineral alkali are to be dissolved in hot water, and powdered cream of tartar thrown in as long as any effervescence arises. For the better crystallization of the salt, the alkali ought to prevail. The liquor must then be filtered and evaporated, and very fine large crystals may be obtained by cold, each of which is the half of a polygonous prism cut in the direction of its axis. This section, which forms a face much larger than the rest, is, like them, a regular rectangle, distinguishable from the others, not only by its breadth, but also by two distinct diagonal lines which intersect each other in the middle. The following method of preparing Siegnette's salt, recommended by Mr Scheele, seems preferable to any other on account of its ease and cheapness. Thirty six ounces of crystals of tartar are to be saturated with potash, and eleven ounces of common salt dissolved in the ley. When it is grown cold, and the vitriolated tartar has subsided to the bottom, it is filtered and evaporated till a pellicle appears; the two first crystallizations yield a fine Seignette's salt; the third contains some digestive salt; and the fourth is entirely composed of it. The reason of this formation of Seignette's salt is, that the vegetable alkali has a greater attraction for acids than the mineral, and therefore decomposes the sea-salt, whose basis is then at liberty to combine with the acid of tartar; while the stronger marine acid takes the vegetable alkali.—A salt of the same kind will be produced by adding Glauber's salt instead of common sea-salt.

892 Cream of tartar.

III. *With Volatile Alkali.* With regard to this combination, all we know as yet is, that if the alkali is over-saturated with acid, a cream of tartar, almost as difficult of solution as that of fixed alkali, will be obtained. When the saturation has been pretty exact, a beautiful salt, composed of four sided pyramids, and which does not deliquate in the air, is produced. It is instantly decompounded, and emits a pungent volatile smell on being mixed with fixed alkali.



IV.

Acid of tartar and its combinations.

893 Selenites tartareous.

IV. *With Earths.* All that is as yet known concerning theſe combinations, is, that with the calcareous earth a compound not eaſily ſoluble in water is formed. The other properties of this ſubſtance, and the nature of combinations of tartareous acid with other earths, are entirely unknown.

894 A fine green colour.

V. *With Copper.* In its metallic ſtate, cream of tartar acts but weakly on the metal, but diſſolves verdegris much more prfectly than diſtilled vinegar can. The ſolution of cream of tartar, being evaporated, does not cryſtallize, but runs into a gummy kind of matter; which, however, does not attract the moiſture of the air. It readily diſſolves in water, and makes a beautiful bluiſh green on paper, which has the property of always ſhining, as if covered with varniſh. The effects of the pure acid on this metal have not yet been tried.

895 Chalybeated tartar.

VI. *With Iron.* The effects of a combination of iron with the pure acid have not hitherto been tried. Cream of tartar diſſolves this metal into a green liquor, which being evaporated runs *per deliquium.* It has been attempted to ſubſtitute a ſolution of this kind to the liquor uſed in printing calicoes formed of iron and ſour beer; but this gave a very dull browniſh colour with madder. Poſſibly, if the pure acid was uſed, the colour might be improved. In medicine, a combination of cream of tartar with iron is uſed, and probably may be an uſeful chalybeate.

VII. *With Regulus of Antimony.* See Sect. III.

## § 8. *Of the Acid of* Sugar.

896 Saccharine acid.

That ſugar contains an acid, which on diſtillation by a ſtrong fire ariſes in a liquid form, in common with that of moſt other vegetable ſubſtances, has been generally known; but how to obtain this acid in a concrete form, and to appearance as pure and cryſtallizable as the acid of tartar, we were entirely ignorant, till the appearance of a treatiſe intitled, *Diſſertatio Chemica, de acido Sacchari, auctore* Johanne Afzelio Arvidſſon, 4to, *Upſaliæ*.

Of the method of procuring, and the properties of, this new acid, we have the following account in the Edinburgh Medical Commentaries, vol. iv.

"1. To an ounce of the fineſt white ſugar in powder, in a tubulated retort, add three ounces of ſtrong ſpirit of nitre.

"2. The ſolution being finiſhed, and the phlogiſton of the ſpirit of nitre moſtly exhaled, let a receiver be properly fitted to the retort and luted, and the liquor then made to boil gently.

"3. When the ſolution has obtained a browniſh colour, add three ounces more of ſpirit of nitre, and let the ebullition be continued till the fumes of the acid are almoſt gone.

897 Chryſtals of ſaccharine acid.

"4. The liquor being at length emptied in a *larger* veſſel, and expoſed to a proper degree of cold, quadrangular priſmatic cryſtals are obſerved to form; which being collected, and dried on ſoft paper, are found to weigh about 109 grains.

"5. The remaining liquor being again boiled in the ſame retort, with two ounces of freſh ſpirit of nitre, till the red vapours begin to diſappear, and being then in the ſame manner expoſed to cryſtallize, about 43 grains of ſaline ſpiculæ are obtained.

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"6. To the liquid that ſtill remains, about two ounces more of ſpirit of nitre being added, and afterwards the whole being, *both by boiling and evaporation,* reduced to a dry maſs, a brown, ſaline, gelatinous kind of ſubſtance is produced, which, when thoroughly dry, is found to weigh about half a drachm.

"In the ſame manner, a ſimilar acid, we are told, may be obtained from different ſaccharine ſubſtances, as *gum-arabic, honey, &c.*; but from none in ſuch quantities, or ſo pure, as from fine ſugar."

898 Preſumption of its expelling the vitriolic acid.

This ſalt poſſeſſes ſome very ſingular properties, of which what appears to us the moſt remarkable, and which we cannot help reading with ſome degree of doubt, is, that it produces an effervеſcence on being added to ſuch *alkaline, earthy, or metallic ſubſtances, as contain the vitriolic acid.* From this we ſhould be apt to think, that this acid was capable of diſlodging even the vitriolic acid from its baſis.

Acid of ſugar, being diſtilled in a retort, gives over about $\frac{3}{10}$ of its weight of water. By an intenſe heat it melts, and is partly ſublimed; leaving in the retort a dark grey maſs, of about the fifth part of the weight of the cryſtals made uſe of. The ſublimed ſalt eaſily recovers the cryſtalline form, and ſeems to have undergone no further change by ſublimation than being rendered more pure. During the diſtillation a great quantity of elaſtic vapour ruſhes out (about 100 cubic inches from half an ounce of the cryſtals), which, from the diſtilled liquor's precipitating lime-water, we may judge to be fixed air. In a ſecond ſublimation, white fumes are ſent over, which, when cold, appear to be an acid, glaſſy-coloured liquor, but cannot be again cryſtallized. "Such parts of the ſalts as adhere to the ſides and necks of the veſſels do not appear to be in the leaſt changed in the proceſs." On a third ſublimation, theſe parts produced ſuch elaſtic vapours as burſt the receiver.

899 Great acid power.

This ſingular ſalt has a conſiderable acid power; twenty grains of it giving a very conſiderable degree of acidity to a large tankard of water. It diſſolves in an equal weight of diſtilled water, but concretes on the liquor's growing cool. It is alſo ſoluble in ſpirit of wine; 100 parts of boiling ſpirit of wine diſſolving 56 of the ſaccharine cryſtals, but no more than 40 when cold. The ſolution in ſpirit of wine ſoon becomes turbid; and depoſites a mucous ſediment, in quantity about $\frac{1}{40}$ of the acid made uſe of. When cold, irregular ſcaly cryſtals are formed, which when dry are perfectly white.

900 Incredible quantity of volatile alkali ſaturated by it.

With vegetable alkali, the acid of ſugar can ſcarcely be formed into cryſtals, unleſs either the alkali or acid predominate. With mineral alkali, a ſalt very difficult of ſolution is formed. The quantity of volatile alkali ſaturated by this acid is incredible. "Six parts of a pure volatile alkali may be ſaturated with one of the acid of ſugar. The produce is a quadrangular priſmatic ſalt. With lime this acid unites ſo ſtrongly, as to be ſeparable by no other means than a ſtrong heat. What kind of a ſalt reſults from this combination we are not told; but the author is of opinion, that this ſhows the uſe of lime in the purification of ſugar, in order to abſorb the ſuperfluous acid. Being ſaturated with ſome of the *terra ponderoſa,* the acid of ſugar immediately depoſits a quantity of pellucid angular cryſtals, ſcarcely ſoluble in water. With magneſia

sia the salt appears in form of a white powder, soluble neither in water nor spirit of wine, unless the acid prevails. It has a stronger affinity with magnesia than any of the alkaline salts. With earth of alum, no crystals are obtained; but a yellow pellucid mass, of a sweetish and somewhat astringent taste; which, in a moist air, liquefies, and increases two-thirds in weight.

901 Its effects on metals.

This acid acts upon all metals, gold, silver, platina, and quicksilver, not excepted, if they have been previously dissolved in an acid, and then precipitated. Iron in its metallic state is dissolved in very large quantity by the saccharine acid; 45 parts of iron being soluble in 55 of acid. By evaporation, the liquor shoots into yellow prismatic crystals, which are easily soluble in water. With cobalt, a quantity of yellow-coloured crystals are obtained, which being dissolved in water, and sea-salt added to the solution, form a sympathetic ink. The elective attractions of this singular acid are, first, lime, than the *terra ponderosa*, magnesia, vegetable alkali mineral alkali, and lastly clays.

902 Saccharine ether.

With spirit of wine an ether was obtained which cannot easily be set on fire unless previously heated, and burns with a blue instead of a white flame.

903 Whether this acid is produced from the nitrous.

Towards the conclusion of his dissertation the author observes, that some may imagine that the acid of nitre made use of in these experiments, may have a considerable share in the production of what he has termed *acid of sugar*. But though he acknowledges that this acid cannot in any way be obtained but by the assistance of spirit of nitre, he is thoroughly convinced that it does not, in any degree, enter into its composition.

What occurs to us on this subject is, that if the acid really pre-exists in the sugar, it must give some tokens of its existence by mixing the sugar with other substances besides spirit of nitre. The author himself thinks that lime acts upon the acid part of the sugar: from whence we are apt to conclude, that by mixing lime, in a certain proportion, with sugar, a compound should be obtained somewhat similar to what was formed by a direct combination of lime with the pure acid. In this case, we might conclude that the nitrous acid produces this salt, by combining with the inflammable part of the sugar, becoming thereby volatile, and flying entirely off, so as to leave the acid of the sugar pure. In the distillation of dulcified spirit of nitre, however, we have an instance of the nitrous acid itself being very much altered. This must therefore suggest a doubt that the acid salt obtained in the present case is only the nitrous acid deprived of its phlogiston, and united with some earthy particles.

In a treatise lately published by Mr Rigby, however, we are informed that sugar itself may be recomposed by uniting the acid of sugar with phlogiston; which assertion, if well founded, undoubtedly decides the dispute in favour of the saccharine acid being originally contained in the sugar.

2d 903 The same with the acid of sorrel.

Late experiments have determined it to be the same with that of sorrel; for which, as well as many other valuable acquisitions, the science of chemistry is indebted to Mr Scheele. Having dissolved as much acid of sugar in cold water as the liquor could take up, he added to this solution some lixivium of tartar drop by drop, waiting a little after each drop, and found the mixture, during the effervescence, full of small crystals, which were genuine salt of wood-sorrel.

3d 903 Fulminating quicksilver.

M. Klaproth having precipitated a nitrous solution of quicksilver with salt of wood-sorrel, perfectly neutralized by vegetable alkali, obtained a white precipitate; which, when edulcorated and dried, and gently heated in a tea-spoon, fulminated with a noise not inferior to that of fulminating gold. Acid of sugar perfectly neutralized with vegetable alkali, afforded the same precipitate, and fulminated in the same manner.

### § 9. *Of the Acid of* Phosphorus.

904 Phosphoric acid.

This acid was first discovered by Homberg in urine; afterwards by Margraaf in mustard and cruciferous plants: M. Bochante discovered it in wheat; and lastly, M. Hassenfratz has traced it in the mineral kingdom with great attention.—He has found that phosphorated iron is contained in all the Prussian blues, when not purified; but that this acid is produced by the coals employed in the process, and is no constituent part of the tinging matter. According to him it occurs almost universally in the minerals of iron which are found in the slimy strata of the earth, as well as those which are undoubtedly modern, whether primary or secondary; unless the iron be so far of a metallic nature as to be attracted by the magnet, or very near that state. It is afforded by the ochry strata, and those which contain hæmatites as well as the slimy kind. Into these it is supposed to have come by the decomposition of vegetables; and to investigate this matter he examined the hibiscus palustris, solidago, virga aurea, antirrhinum, lunaria, solanum nigrum, vulgatum, stachys palustris, artemisia Zeylandica, ruta graveolens, lycopus Europeus, carex acuta; vinca major, nepeta Pannonica, and noa Abyssina. All these plants afforded the acid of wood-sorrel and the phosphoric acid. The quantity of the former varied from two ounces to two drachms 18 grains of acid salt containing some calcareous earth, to two drachms 24 grains in a pound of each plant; the quantity of calcareous phosphoric salt being from one ounce six drachms 48 grains to one drachm 12 grains.—M. Hassenfratz also observes, that the phosphoric acid is procurable from all sorts of iron; though in some it seems to proceed from that contained in the earth, and in others from the coals employed in the reduction.

The phosphoric acid is also found by Dr Marquart to be contained in the gastric juice of animals. One pound four ounces of the gastric juice of oxen gave 10 grains of a lymphatic matter, exactly like the blood in its qualities; 16 grains and six-sevenths of phosphoric acid, which with a blow-pipe was changed into a very pure and deliquescent glass of phosphorus; five grains of phosphorated lime, two grains of resin, 14 grains of sal ammoniac, 29 grains of common salt, a very small quantity of an extract whose nature was difficult to ascertain; one pound three ounces six drachms and $67\frac{1}{7}$ grains of water; so that the solid contents were only 166th part of the bulk.

In sheep, the quantity of gastric juice was about eight ounces in quantity, of a deeper and brighter green

Acid of phoſphorus and its combinations.

green than that of oxen or calves; but affording the ſame ingredients, though in a different proportion; though no other acid than that of phoſphorus could be diſcovered. It was alſo more diſpoſed to putrefaction. Calves furniſhed from four to ſix ounces of gaſtric juice, which contained very little lymph, but afforded ſome quantity of dry jelly, though the whole was not equal to the proper proportion of lymph. The phoſphorated lime was in the uſual quantity, but the diſengaged phoſphoric acid in a very ſmall proportion. The lacteal acid was found in great quantity; to which, along with that of phoſphorus, our author ſuppoſes the property of curdling the milk in the animal's ſtomach to be owing.

The phoſphoric acid has alſo been found in very large quantity in the calcareous ſtones of Andaluſia; and Mr Klaproth has found the ſame combined with calcareous earth in a kind of beryl, cryſtallized in hexahedral priſms, called by M. Verner *apatit*.—Formerly the beſt method of obtaining it was from urine, where it is contained in very conſiderable quantity in combination with the volatile alkali, and forming a ſalt called the *microcoſmic*, or *eſſential ſalt of urine*.

905 Microcoſmic ſalt, how procured.

To procure this, a large quantity of urine is to be evaporated to the conſiſtence of a thin ſyrup; which, being ſet in a cold place, will yield, in three or four weeks, foul brown-coloured cryſtals, which are the microcoſmic ſalt, mixed with the marine, and other ſalts of urine. Theſe cryſtals are to be diſſolved in hot water; the ſolution filtered whilſt it continues hot, and ſet to cryſtallize again; and the ſolution, filtration, and cryſtallization, repeated till the ſalt becomes pure and white. In all the cryſtallizations the microcoſmic ſalt ſhoots firſt, and is eaſily diſtinguiſhed and ſeparated from the others. If the urine which remains after the firſt cryſtallization be further evaporated, and again ſet in the cold, it will yield more cryſtals; but browner and more impure than the former; and therefore requiring to be purified by themſelves. From 20 gallons of urine may be obtained four ounces of pure ſalt; a conſiderable part being ſtill left in the reſiduum.

In theſe operations the heat ought to be gentle, and the veſſels either of glaſs or compact ſtone-ware. Urine being evaporated in a copper veſſel, afforded only a green ſolution of that metal.

906 Mr Margraaf's experiments.

Concerning the nature of the microcoſmic ſalt obtained by the above proceſs, Mr Margraaf gives the following account in the Berlin memoirs for 1746.

"Sixteen ounces of the ſalt, diſtilled in a glaſs retort, in a heat gradually raiſed, gave over eight ounces of a volatile urinous ſpirit, reſembling that made from ſal ammoniac by quicklime. The reſiduum was a porous brittle maſs, weighing eight ounces. This, urged with a ſtronger fire in a crucible, bubbled and frothed much, and at length ſunk down into the appearance of glaſs, without ſeeming to ſuffer any further diminution of its weight in the moſt vehement heat.

The vitreous matter diſſolved in twice or thrice its quantity of water, into a clear, tranſparent, acid liquor, ſomewhat thick, not ill reſembling in conſiſtence concentrated oil of vitriol. This liquor totally corroded zinc into a white powder, which, being diluted with water, appeared in great part to diſſolve, fixed alkalies occaſioning a plentiful precipitation. It acted powerfully upon iron, with ſome efferveſcence; and changed the metal into a kind of muddy ſubſtance inclining to bluiſh, in part ſoluble in water like the preceding. It diſſolved likewiſe a portion of regulus of antimony, and extracted a red tincture from cobalt. On lead and tin it had very little action. Copper it corroded but ſlightly. On biſmuth, ſilver, and gold, it had no effect at all, either by ſtrong digeſtion, or a boiling heat. Nor did the adding of a conſiderable portion of nitrous acid enable it to act upon gold.

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"The vitreous ſalt in its dry form, melted with metallic bodies with a ſtrong fire, acts upon them more powerfully. In each of the following experiments, two drachms of the ſalt were taken to two ſcruples of the metal reduced to ſmall parts. (1.) Gold communicated a purple colour to the vitreous ſalt; on weighing the metal, however, its diminution was not conſiderable. (2.) Silver loſt four grains, or $\frac{1}{10}$; and rendered the ſalt yellowiſh, and moderately opaque. (3.) Copper loſt only two grains, or $\frac{1}{20}$, though the ſalt was tinged of a deep green colour. It ſeemed as if a portion of the ſalt had been retained by the metal, which, after the fuſion, was found to be whiter and more brittle than before. (4.) During the fuſion with iron, flaſhes like lightning were continually thrown out; a phoſphorus being generated from the combination of the acid with the inflammable principle of the iron. Great part of the mixture riſes up in froth; which, when cold, appears a vitreous ſcoria, covered on the ſurface with a kind of metallic ſkin, which, on being rubbed, changes its green colour to a yellowiſh. The reſt of the iron remains at the bottom of the crucible, half melted, half vitrified, and ſpongy. (5.) Tin loſt 18 grains, or nearly one-half its weight, and rendered the ſalt whitiſh; the remaining metal being at the ſame time remarkably changed. It was all over leafy and brilliant, very brittle, internally like zinc. Laid on burning coals, it firſt began to melt, then burnt like zinc, or phoſphorus. (6.) Lead loſt 16 grains, and gave the ſame whitiſh colour to the ſcoriæ that tin does. The remaining lead was in like manner inflammable, but burnt leſs vehemently than the tin; from which it differed alſo in retaining its malleability. (7.) Mercury precipitated from aquafortis, and well edulcorated, being treated with the ſalt in a glaſs retort, with a fire raiſed to the utmoſt, only 12 grains of mercury ſublimed; 28 remaining united with the acid, in a whitiſh, ſemi-opaque maſs. A ſolution of this mixed in diſtilled water, depoſited a quantity of a yellowiſh powder; which, by diſtillation in a glaſs retort, was in great part revived into a running mercury. A part alſo remained diſſolved in the clear liquor; for a drop let fall on poliſhed copper inſtantly whitened it. (8.) Regulus of antimony melted with the vitreous ſalt, loſt eight or nine grains, (about $\frac{1}{5}$); the regulus aſſumed a fine, brilliant, ſtriated appearance; the ſcoriæ were ſomewhat opaque. (9.) Biſmuth loſt eight grains; the ſcoriæ were like the preceding, but the biſmuth itſelf ſuffered little change. (10.) Zinc, mixed with the ſalt, and diſtilled in a glaſs retort, yielded a true phoſphorus, which aroſe in a very moderate heat. The reſiduum was of a grey colour, a little melted at



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the bottom, in weight not exceeding two drachms; so that two scruples had sublimed. This residuum, urged further in a small Hessian crucible to perfect fusion, emitted an infinity of phosphorine flashes, with a kind of detonation. The matter, grown cold, looked like the scoriæ of melted glass. (11.) White arsenic, mixed with this salt, separated in the fire, greatest part of it subliming, and only as much remaining behind as increased the weight of the salt eight or nine grains. This compound appeared at first transparent; but, on being exposed to the air, became moist, and of an opaque whiteness, much resembling crystalline arsenic. (12.) Cinnabar totally sublimed; suffering no change itself, and occasioning none in the salt. Sulphur did the same. (13.) One part of the salt, mixed with ten of manganese, and melted in a close vessel, gave a semitransparent mass, some parts of which were bluish. The crucible was lined with a fine purple glazing, and the edges of the mass itself appeared of the same colour.

"The vitreous salt dissolved also, in fusion, metallic calces and earths. Chalk, with one-third its weight of the salt, formed a semitransparent vitreous mass: calcined marble, with the same proportion, flowed so thin as to run all through the crucible; gypsum, likewise, ran mostly through the crucible; what remained was semitransparent. Lapis specularis ran entirely through the vessel. Spanish chalk gave a semitransparent mass, which sparkled on breaking; and fine white clay, a similar one. Saxon topaz and flint were changed into beautiful opal-coloured masses; the earth of alum into a semitransparent mass, and quicklime into an opaque white one. The mass with flints imbibed moisture from the air; the others not.

"Oil of vitriol, poured upon one-fourth its weight of this salt in a retort, raised an effervescence, acquired a brownish colour, and afterwards became turbid and white. On raising the fire, the oil of vitriol distilled, and the matter in the bottom of the retort melted. In the neck was found a little sublimate, which grew moist in the air; as did likewise the remaining salt, which was opaque and whitish. Concentrated spirit of nitre, distilled with this salt in the above proportion, came over unchanged; no sublimate appeared; the residuum looked like glass of borax. The distilled spirit did not act in the least upon gold, even by coction. Strong spirit of sea-salt being distilled in the same manner, no sensible change was made either in the spirit or the salt.

"Equal parts of the vitrified microcosmic salt and salt of tartar being urged with the strongest fire that a glass retort could bear, nothing sensible came over, nor did the mixture appear in thin fusion. Dissolved in water, filtered, and duly evaporated, it afforded, very difficultly, oblong crystals, somewhat alkaline; the quantity of alkali having been more than enough to saturate the acid. A whitish matter remained on the filter, amounting to seven or eight grains, from two drachms of the mixture; this, after being washed and dried, melted before a blow-pipe, as did likewise the crystals.

907 Expels the acids of vitriolated tartar, nitre, and sea-salt.

"This salt seems to extricate, in part, the acids of vitriolated tartar, nitre, and sea-salt. (1.) On distilling a mixture of it with an equal quantity of vitriolated tartar, there came over some ponderous acid drops, which, saturated with fixed alkali, formed a neutral salt greatly resembling the vitriolated tartar. The residuum readily dissolved in water, and difficultly crystallized. (2.) Nitre, treated with the same proportion of the salt, began to emit red vapours. The residuum was of a peach-blossom colour, appeared to have melted less perfectly than the preceding, and dissolved more difficultly in water. The solution deposited a little earthy matter; and, on being slowly evaporated, shot into crystals, which did not deflagrate in the fire. (3.) Sea-salt, distilled in the same manner, manifestly parted with its acid; the residuum was whitish, readily dissolved in water, and afforded some cubical crystals. (4.) Sal ammoniac suffered no change. (5.) Borax, with an equal quantity of vitreous salt, run all through the crucibles.

"Solutions of this salt precipitated the earthy part of lime-water, of solution of alum, of flint dissolved in fixed alkali, and the combination of marine acid with chalk or quicklime. The precipitate from this last liquor is tenacious like glue, and does not dissolve even in boiling water; exposed to a strong fire, it froths prodigiously, and at last melts into a thick scoria.

"Solutions of this salt precipitate also sundry metallic solutions; as butter of antimony, solutions of silver, copper, lead, iron, mercury, and bismuth, in the nitrous acid; and of tin in aqua-regis. The precipitate of iron from spirit of salt is a tenacious mass; that of silver from aquafortis, sometimes a white powder, sometimes tenacious. Copper from aquafortis is sometimes thrown down in form of a white powder, and sometimes in that of a green oil, according to the proportions and diluteness of the liquor. Silver is not precipitated at all by this acid from its solution in vinegar, nor gold from aqua-regis.

"An ounce of the vitreous salt, well mixed with half an ounce of soot, and committed to distillation, yielded a drachm of fine phosphorus. The black residuum, being elixated with boiling water, and the liquor passed through a filter, there remained upon the filter eight scruples of a black matter; and, on evaporating and crystallizing the liquor, about seven drachms were obtained of oblong crystals, which did not deliquate in a moist air, but became powdery in a warm one. These crystals, treated afresh with inflammable matter, yielded no phosphorus. Before a blow-pipe they melted into a transparent globular mass, which on cooling, became turbid and opaque. Dissolved in water, they precipitated solutions of silver, mercury, copper, and of chalk; though they did not act upon the latter so powerfully, nor produce with it a gluey mass, as before they had been deprived of their phosphorine acid."

Mr Wiegleb informs us, that the phosphoric acid exhibits less affinity with calcareous earth, in the moist way, than the vitriolic; though it cannot be separated from the ultimate residuum of the calcareous earth by that acid. It expels, however, all the liquid acids from their basis in the dry way. It precipitates iron from a solution in vitriolic acid, of a perfectly white colour. For the uses of this acid as a flux, see the article *Blow-pipe*.

### § 10. *Of the Acid of Ants.*

2d 907 How procured.

The acid may be obtained from these insects either by

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by distillation, or simple infusion in water. From twenty-four ounces of ants, Neumann obtained eleven ounces and a half of acid as strong as good vinegar, by distillation in balneo mariæ. Of this acid, Mr Margraaf gives the following account in the Berlin Memoirs for 1749.

908 Its properties.

"The acid of ants effervesces with alkaline salts, both fixed and volatile. With volatile alkalies it forms a neutral liquor, which, like that composed of the same alkalies and vinegar, yields no concrete salt on distillation. With fixed alkalies it concretes, upon proper exhalation, into oblong crystals, which deliquate in the air. The crystals, or the saturated neutral liquor uncrystallized, on being distilled with a fire increased till the retort began to melt, yielded, a liquor scarce sensibly acid, and afterwards a small quantity of an urinous and partly ammoniacal liquor. The remaining black matter, dissolved in distilled water, filtered and evaporated, shot into large crystals which did not deliquate in the air, though they were in taste strongly alkaline, effervesced with acids, and had all the other properties by which fixed alkalies are distinguished.

"This acid dissolves, with great effervescence, coral, chalk and quicklime; and concretes with them all into crystals which do not deliquate in the air.

"It does not precipitate silver, lead, or mercury, from the nitrous acid; nor quicklime from the marine. Hence it appears to have no analogy to the marine or vitriolic acids; the first of which constantly precipitates the metallic solutions, and the other the earthy.

"It does not act upon filings of silver; but (like vegetable acids), it totally dissolves, by the assistance of heat, the calx of silver precipitated from aquafortis by salt of tartar.

"It does not dissolve calces of mercury, (as vegetable acids do); but revives them into running quicksilver.

"It acts very weakly upon filings of copper; but perfectly dissolves copper that has been calcined. The solution yields beautiful compact green crystals.

"It dissolves iron-filings with violence; the solution duly evaporated, shoots into crystals more readily than that made in distilled vinegar. It scarcely acts at all upon filings of tin.

"It does not, according to Mr Margraaf, corrode filings of lead; but dissolves, by the assistance of heat the red calx of lead. The solution crystallizes into a saccharum saturni. In Mr Ray's philosophical letters, it is said, that *lead* put into the acid spirit, or fair water, together with the animals themselves, makes a good *saccharum saturni;* and that this saccharum, on being distilled will afford the same acid spirit again, which the saccharum saturni made with vinegar will not do, but returns an inflammable oil with water, but nothing that is acid; and saccharum saturni made with spirit of verdegris doth the same in this respect with the spirit of pismires.

"It dissolves zinc with vehemence, and shoots, upon due evaporation, into inelegant crystals, not at all like those produced with distilled vinegar. On bismuth, or regulus of antimony, it has little effect, either when calcined or in their metalline state.

### § II. *Of the Acid of* Amber.

Acid of amber and its combinations.

The nature of this acid is as yet but little known, and Mr Pott is the only chemist who seems to have examined it with accuracy. We shall therefore give an abstract of the principal observations and experiments he has made on this salt.

909 Mr Pott's experiments.

"Salt of amber requires a large quantity of water for its solution. In the first crystallization (being much impregnated with the oil which rises from the amber along with it), it shoots into spongy flakes, in colour resembling brown sugar-candy; the crystals which succeed prove darker and darker coloured. On repeating the depuration, the crystals appear at top of a clear yellow or whitish colour, in form of long needles or feathers; at bottom, darker, and more irregular, as are likewise the crystals which shoot afterwards. The crystals neither liquefy nor become powdry in the air: rubbed, they emit a pungent smell like that of radishes, especially if warmed a little; their taste is acid, not in the least corrosive, but with a kind of oily pungency.

"This salt, kept in the heat of boiling water, loses nothing of its weight, and suffers no alteration. In a great heat it melts like oil; after which a little oily acid arises, then oily striæ appear in the lower part of the retort, and the salt sublimes into the neck, partly in the form of a dark yellow butter, and partly in that of feathers, a black coaly matter remaining at bottom; so that, by this process, a part of the salt is destroyed.

"Oil of turpentine has no action on this salt. Highly rectified spirit of wine gains from it a yellow colour in the cold; and, on the application of heat, dissolves a considerable quantity, but deposites great part of it on cooling. The salt thus deposited is somewhat whiter than before, but still continues sensibly yellow. The dulcified spirit of sal ammoniac dissolves it readily, without effervescence, into a yellow liqour; if the salt was foul, the solution proves of a red colour; on burning of the vinous spirit, a neutral liquor remains.

"A solution of salt of amber in water, saturated with a pure alkaline lixivium, yielded, on inspissation, a saline matter, which would not crystallize, and which when exsiccated by heat, deliquated in the air, leaving a considerable proportion of an earthy, unctuous matter. Being again gently inspissated, it left a brownish salt very soluble, weighing one half more than the salt of amber employed. This salt effervesced with the vitriolic and nitrous acids: the vapour, which exhaled, was not acid, but oily and sulphureous. On repeating the experiment, and fully saturating the alkali with the salt of amber, the neutral salt made no effervescence with these acids. This salt did not perfectly melt before a blow-pipe; continued in the fire for some time, it effervesced with aquafortis. In distillation it yielded a bitter, oily, alkalescent spirit, much resembling the spirit of tartar; and towards the end, an empyreumatic oil. The residuum elixated, yielded the alkaline salt again of a brown colour.

"Salt of amber effervesces strongly with volatile alkalies; and, on saturation, forms with them an oily am-

Acid of amber and its combinations.

ammoniacal liquor, which, in diſtillation, totally ariſes in a fluid form, except that a ſmall portion of a penetrating, oily, ſaline matter, concretes towards the end.

910 Extricates the acids of ſal ammoniac and nitre.

"On diſtilling ſalt of amber with an equal quantity of common ſal ammoniac, a marine acid ſpirit came over, of a ſtrong ſmell, and a brown colour: afterwards, a little white ſal ammoniac ſublimed; at length aroſe ſuddenly a large quantity of a fuliginous or bituminous matter, leaving behind a ſmall portion of a like ſhining black ſubſtance. The coaly matter was conſiderably more in quantity than the ſalt of amber employed. On treating it with nitre, red vapours aroſe, and the mixture detonated with violence. A mixture of it with borax, frothed and ſwelled up much more than borax by itſelf; and, on raiſing the fire, yielded only ſome oily drops; the acid being deſtroyed by this ſalt, as by fixed alkalies and quicklime.

911 Purified by the marine acid.

"Spirit of ſea-ſalt, poured upon one-fourth its weight of ſalt of amber, made ſcarce any ſolution in the cold: on the application of heat, nearly the whole coagulated into the conſiſtence of a jelly. In diſtillation, the ſpirit of ſalt aroſe firſt; then almoſt the whole of the ſalt of amber, partly like firm butter, partly like long ſtriated plumous alum, very pure, and of a fine white colour, its oily matter being changed into a coal at the bottom. The ſalt, thus purified, makes no precipitation in the ſolution of ſilver, and conſequently retains nothing of the marine acid; nor does it precipitate ſolution of quicklime made in ſpirit of ſalt, and conſequently contains nothing vitriolic. If any of the mineral acids was contained in this ſalt, it could not here eſcape diſcovery; the oil, which in the rough ſalt is ſuppoſed to conceal the acid, being in this proceſs ſeparated.

912 Effects of ſpirit of nitre on it.

"Aquafortis being poured upon one-fourth its weight of ſalt of amber, extracted a yellowiſh colour from it in the cold, but diſſolved little: on the application of heat, the whole diſſolves into a clear liquor, without any coagulation: if the ſalt is very oily, the ſolution proves red. In diſtillation, the greateſt part ariſes in a liquid form, with only a very ſmall quantity of concrete ſalt. The ſpirit does not act upon gold, but diſſolves ſilver, and quickſilver, as at firſt; a proof that it has received no marine acid from the ſalt of amber.

913 Of oil of vitriol.

"Oil of vitriol being added to twice its weight of ſalt of amber diluted with a little water, a moderate fire elevated an acidulous, liquor, which appeared to proceed from the ſalt of amber; for its making no change in ſolution of fixed ſal ammoniac, ſhowed it not to be vitriolic. On continuing the diſtillation by a ſtronger fire, greateſt part of the ſalt ariſes undeſtroyed, and the oil of vitriol along with it; a black, light, porous earth remaining.

914 Of quickſilver.

"Equal parts of quicklime and ſalt of amber gave over in diſtillation only an acidulous phlegm; the reſiduum, elixated with water, yielded a ſolution of the lime in the acid of amber, reſembling a ſolution of the ſame earth in vegetable acids, precipitable by alkaline ſalts, and by the vitriolic acid. Lime, added to a watery ſolution of ſalt of amber, diſſolves with ſome efferveſcence; after which, the whole coagulates into the conſiſtence of a jelly: this, diluted with water, proves ſimilar to the foregoing ſolution.

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"Solution of ſalt of amber makes no precipitation in ſolution of ſilver or quickſilver. It diſſolves zinc, as all acids do: fixed alkalies precipitate the zinc: the volatile do not; and when a ſufficient quantity of the volatile has been added, the fixed make no precipitation. It acts exceedingly ſlowly and difficultly upon copper; but corrodes calcined copper in a ſhorter time. It ſoon corrodes iron, by coction, into a crocus, and diſſolves a part into a liquid form: the ſolution has little colour; but alkaine ſalts readily diſcover that it holds iron, by rendering it turbid and whitiſh, and throwing down a conſiderable quantity of a greeniſh calx." 915 Effects of ſalt of amber on the metals.

## § 12. *Of the acid of* Arsenic.

Mr Scheele firſt perceived, from ſome experiments on manganeſe, that arſenic contained phlogiſton: from whence he was led to an analyſis of this ſubſtance, which produced an acid of a very ſingular kind; by uniting of which with phlogiſton in certain proportions, either white arſenic or its regulus may be compoſed at pleaſure. 916 How firſt diſcovered.

White arſenic may be decompounded in two ways. 917 Two ways of decompounding arſenic.
1. Put two ounces of it reduced to a fine powder in a glaſs mortar into a retort of the ſame materials; pour upon it ſeven ounces of pure muriatic acid, whoſe ſpecific gravity is to that of water as 10 to 8; and lute on a receiver. The arſenic is quickly diſſolved in a boiling heat, which muſt be brought on as quickly as poſſible. After the ſolution is accompliſhed, while the 918 By means of nitrous acid.
liquor is ſtill warm, three ounces and a half of nitrous acid, of the ſame ſpecific gravity with the muriatic above-mentioned, is to be added, and the liquid which had already gone over into the receiver poured back. The receiver is then to be put on again, but not luted; the mixture ſoon begins to efferveſce, and red vapours go over into the receiver. The diſtillation is to be continued till theſe vapours ceaſe; when an ounce of finely powdered arſenic is again to be added, the receiver applied as before, and a gentle ebullition continued till the ſecond quantity of arſenic be diſſolved. An ounce and an half of nitrous acid is then to be added, and the mixture diſtilled to dryneſs, increaſing the fire towards the end, ſo as to make the retort red hot. The acid which comes over into the receiver may ſerve again ſeveral times. The white maſs which remains in the retort is the dry acid of arſenic. It may be reduced to a liquid form by pouring upon it, in coarſe powder, twice its weight of diſtilled water, and boiling for a few minutes, pouring back the liquor which comes over, and afterwards filtering the ſolution through blotting paper, which has been previouſly waſhed in hot water.

In this proceſs the nitrous acid attacks the phlogiſton of the arſenic, is volatilized in conſequence of its union with it, and leaves the more fixed but leſs powerful acid of arſenic behind. The nitrous acid would alone be ſufficient for this purpoſe, could it accurately come into contact with the particles of arſenic; but this cannot be done witthout ſolution, and the nitrous acid is capable of diſſolving arſenic only in pro-

Acid of arsenic and its combinations.

proportion to the water it contains. Too great a quantity would therefore be required were this acid to be used by itself; but by the use of muriatic acid for the solution, a smaller quantity of spirit of nitre is admitted to intimate contact with all the arsenical particles, and has an opportunity of depriving them of their phlogiston. Aqua-regia might be poured upon the arsenic at once; but the greatest effervescence it excites would throw the mineral up to the top in such a manner that the menstruum could not act upon it. By the operation of dephlogistication, arsenic loses a fifth part, which is supposed to be pure phlogiston.

919 By dephlogisticated spirit of salt.

The other method of decomposing arsenic is, by means of the dephlogisticated spirit of salt. For this purpose, take one part of powdered manganese, and mix it with three of the muriatic acid above-mentioned. Put it into a retort, of which it may fill one-fourth; a receiver containing one-fourth of powdered arsenic, with one-eighth of distilled water, is to be luted on, and the retort put into a sand-bath. The dephlogisticated muriatic acid, going over into the receiver, is instantly absorbed by the arsenic; which some hours afterwards will be dissolved, and two different liquid strata, which cannot be mixed together, will be perceived in the receiver. This solution is now to be put into a clean glass retort, and distilled to dryness; increasing the fire at last to such a degree as to make the whole red hot: and in this process also two different liquids pass over into the receiver which do not unite together.

Here the manganese attracts the phlogiston of the muriatic acid; and as this dephlogisticated acid has a very strong attraction for phlogiston, it deprives the arsenic of its phlogiston, and thus recomposes the ordinary phlogisticated muriatic acid. This portion of recomposed acid dissolves part of the arsenic, forming with it what is called *butter of arsenic*. The other part of the arsenic which has been decomposed, dissolves in the water, and forms a liquid specifically lighter than the butter, and therefore swims above it. On rectifying the two liquids, the undecomposed portion of the arsenic arises along with the muriatic acid, and goes over into the receiver in form of an heavy oil, while the acid of arsenic remains behind in the retort. The acid obtained in this way is precisely the same with the former, and one would hardly believe that it is an acid, because it has no acid taste; but after some days it grows moist in the air, and at last deliquates, assuming the appearance of oil of vitriol. As the deliquescence, however, is very slow, it is proper to dissolve it in a certain quantity of water, when a small quantity of white powder remains undissolved, after preparing it by the first process, which is siliceous earth derived from the retort. This ought to be carefully separated from the acid by filtration; and in order to prevent the glue of the blotting-paper from mixing with the acid, it was directed to wash the filter with hot water previous to the operation.

920 Acid of arsenic equally poisonous with the white arsenic itself.

The first experiment M. Scheele tried on this acid after he had obtained it, was to discover if it was as noxious to animals as when combined with phlogiston. Having mixed a little with honey, the flies that eat of it died in an hour; and eight grains reduced a cat to the point of death in two hours. Some milk, however, being then given to the animal, it vomited violently, and ran away.

2. An ounce of dry acid of arsenic, heated in a small phial to near the point of ignition, melts into a clear liquid, which congeals when cold; but if the heat be increased till the vessel begins to melt, the acid begins to boil, resumes its phlogiston, and arsenic sublimes in greater quantity as the heat is longer continued. After subjecting the acid to this violent heat in a retort for an hour, the vessel melted, and the acid had risen up as high as the neck.

921 Easily resumes its phlogiston.

3. In a crucible the arsenic attracts phlogiston in greater quantity, and is entirely dissipated in arsenical vapours; a little clear and difficultly fusible glass, consisting of clay and the acid of arsenic, remaining in the crucible.

922 Takes fire and sublimes charcoal.

3. With powder of charcoal the arsenical acid undergoes no change; but if the mixture be put into a retort, the moisture all driven off, a receiver then luted on, and the heat increased till the bottom of the retort becomes red hot, the whole mass takes fire with violence; all the acid is reduced, and sublimed into the neck of the retort; a shining regulus is obtained, mixed with a little arsenic and charcoal dust. A few drops of water are found in the receiver, but they do not contain a particle of acid.

923 Appearance with oil of turpentine, &c.

4. The arsenical acid, after some days digestion with oil of turpentine, unctuous oil, and sugar, becomes black and thick. If some muriatic acid be distilled from this, a little nitrous acid added, and the distillation repeated, some acid of arsenic is left behind. Spirit of wine undergoes no change either by digestion or distillation with arsenical acid.

924 With sulphur.

5. Six parts of acid digested with one of sulphur suffer no change; but when the mixture is evaporated to dryness, and then subjected to distillation in a glass retort, the two unite with great violence at that degree of heat in which sulphur melts; and the whole mass rises almost in the same instant, in form of a red sublimate; a little sulphureous acid in the mean time going over into the receiver.

925 Combined with vegetable fixed alkali.

6. Acid of arsenic, saturated with vegetable fixed alkali, forms a deliquescent salt which does not crystallize, but turns syrup of a violet green, though it produces no change on the tincture of lacmus. On the addition of a little more acid, however, when it reddens lacmus, but makes no alteration on the syrup of violets, the liquor will afford fine crystals like Mr Macquer's neutral salt of arsenic. On keeping this salt for an hour in fusion in a crucible covered with another luted upon it, the inside of the vessel was found covered with a white glazing, and a salt remained, which was still the same arsenicated salt with excess of acid.

926 This salt decomposed by charcoal.

7. On distilling this salt in a retort with an eighth-part of charcoal-dust, it began to boil very violently as soon as the retort became red-hot, and a very fine regulus of arsenic sublimed. The black residuum contained the alkali entirely separated from the arsenical acid.

927 Combined with mineral alkali.

8. With mineral alkali the acid of arsenic forms crystals when perfectly neutralized, but not if added to excess. In that case, the mass becomes deliquescent like the former when neutral.

928 With volatile alkali.

9. With volatile alkali a salt much resembling the two

Acid of arsenic and its combinations.

two former is produced. It does not change lacmus, but turns the syrup of violets green. A gentle heat drives off part of its volatile alkali, and leaves the remainder supersaturated with acid; in which case it shoots into long radiated and deliquescent crystals. These, urged by a stronger heat, part with the whole of their alkali, which is partly decomposed; some arsenic is formed by the union of the phlogiston of the alkali with part of the arsenical acid; the remainder of which assumes a milky colour, and lies in the bottom of the retort.

929 Expels the acid of vitriolated tartar by dry distillation.

10. Acid of arsenic distilled with vitriolated tartar expels the vitriolic acid in a violent heat, which comes over in a concentrated but sulphureous state, leaving the arsenical salt formed of the acid and alkali united. With Glauber's salt the vitriolic acid also rises, and with less heat than when vitriolated tartar is made use of.

930 Acid of nitre;

11. One part of nitre distilled with three of acid of arsenic, yielded a spirit of nitre, together with the neutral arsenical salt already mentioned.

931 Of common salt.

12. One part of common salt with three of arsenical acid, yielded some smoking part of salt. The residuum dissolved in water gave crystals of common salt, and a thick magnum, which would not crystallize till the superfluous arsenical acid was taken away by adding powdered chalk, when it yielded crystals similar to those produced by the acid and pure alkali.

932 Phenomena with sal ammoniac.

13. With sal ammoniac the product was first fuming muriatic acid, then volatile alkali in a liquid state, after that arsenic, and lastly part of the arsenical acid remained in the retort.

633 Decomposes spathum ponderosum and gypsum.

14. Spathum ponderosum, and gypsum, both parted with their acids, which were become sulphureous. The former did not yield its acid till the retort began to melt.

634 Cannot expel the fluor acid.

15. One part of fluor mineral was mixed with four of acid of arsenic, and distilled into a receiver having a little water in it. When the retort grew red-hot, first a yellow and then a red substance sublimed. Some sulphureous acid, but none of the acid of fluor, went over. A grey-coloured residuum was left in the retort; which being divided into two parts, one was mixed with charcoal-powder and distilled with a strong fire, without the production of either arsenic or regulus; the other was mixed with four parts of acid of arsenic, and subjected to a second distillation. When the mass grew dry, a little yellow sal ammoniac was sublimed, and the water was covered with a crust of siliceous earth, as in the usual distillations of that mineral.

635 Precipitates lime water

16. Arsenical acid precipitates lime-water, by uniting with the calcareous earth dissolved in it. By the addition of more acid, the precipitate is dissolved, and the liquor yields small crystals, which let fall a selenite on the addition of vitriolic acid.

636 Phenomena with chalk.

17. On the addition of powdered chalk to arsenical acid diluted with water, the earth is at first dissolved, but by adding more chalk the whole is coagulated into small crystals.

937 With magnesia.

18. Magnesia dissolves in the arsenical acid, and the solution coagulates when it comes to the point of saturation. On dissolving the coagulum in a larger quantity of water, it becomes gelatinous by evaporation; and if the jelly be lixiviated with water, filtered, and evaporated, a viscid mass remains, which refuses to crystallize.

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19. Earth of alum precipitated by alkali of tartar, is easily soluble in arsenical acid, and coagulates as soon as it arrives at the point of saturation. Evaporated to dryness, mixed with some charcoal powder, and then subjected to strong distillation, a little yellow sublimate arises into the neck of the retort, as likewise some shining regulus, while a volatile sulphureous acid passes over into the receiver. The residuum dissolves with difficulty in the vitriolic acid, though some crystals of alum will form in the space of two months. 938 With earth of alum.

20. Four parts of arsenical acid mixed with one of powdered white clay, did not dissolve any part by digestion for a fortnight. By distillation in a retort till the vessel began to melt, it was converted into a thick flux, and a little arsenic sublimed. By mixing the residuum with a little powdered charcoal, a shining regulus was sublimed. 939 With white clay.

21. Terra ponderosa dissolves readily in the acid of arsenic, but precipitates again as soon as it has attained the point of saturation. The solution is precipitated by acid of vitriol, and forms regenerated ponderous spar. 940 With terra ponderosa.

22. Gold is not acted upon by acid of arsenic, either by digestion or otherwise; nor is its solution precipitated, though the retorts used in the operation were stained with red and yellow spots, which could not be taken off; nor is its action increased by mixture with muriatic or with nitrous acid. 941 With gold.

23. Pure platina is not acted upon. Its solution is not precipitated by the pure arsenical acid, but readily by the arsenical salts. The precipitate is yellow, and dissolves in a large quantity of water, but contains no mark of arsenical acid. Addition of muriatic or of nitrous acid makes no change in its effects. 942 Platina.

24. Pure silver is not acted upon by the arsenical acid in digestion. On augmenting the fire till the acid melted, and keeping up this degree of heat for half an hour, the metal dissolved, and on breaking the retort, a colourless glassy mass, nearly transparent, was found in it; the retort being covered with a flame-coloured glazing, which could not be separated from it. By a great degree of heat the silver was reduced without addition. Solution of silver is precipitated by pure acid of arsenic, but more effectually by the neutral arsenical salts: the precipitate is of a brown colour, and by digestion in muriatic acid is changed into lunea cornea; it is also soluble in spirit of sal ammoniac prepared with quicklime. The action of the arsenical acid upon silver is considerably increased by mixing it with spirit of sea-salt; the former attacking the phlogiston of the metal, while the latter attacks its earthy basis. 943 Silver.

25. Quicksilver is not acted upon by digestion with arsenical acid. On putting the mixture into a retort, distilling to dryness, and then increasing the fire, the mass becomes yellow, quicksilver rises into the neck of the retort, with a little arsenic, and some yellow sublimate; but though the fire was augmented till the retort began to melt, the mass could not be fused. Three drachms and an half of quicksilver were obtained out of six employed in the experiment; the arsenical acid, therefore, contained two and an half. The mass was somewhat yellow: it dissolved very readily in muriatic acid, but scarcely at all in the nitrous or vitriolic; on evaporation to dryness and distillation, some corrosive sublimate 944 Quicksilver.

Acid of arſenic and its combinations.

ſublimate roſe into the neck of the retort; the reſiduum, melted in a very ſtrong fire, proved to be acid arſenic. Another portion of the maſs, diſtilled with two parts of common ſalt, yielded corroſive ſublimate.

945 With corroſive ſublimate.

26. Acid of arſenic diſtilled with corroſive ſublimate undergoes no change; but by ſublimation with mercurius dulcis, a corroſive ſublimate is obtained. Some have aſſerted, that by ſubliming arſenic with corroſive ſublimate, a butter of arſenic is obtained; but Mr Scheele informs us that this is a miſtake; and that by diſtilling this mixture, he conſtantly obtained corroſive ſublimate at firſt, and arſenic afterwards. With regulus of arſenic, however, a ſmoking butter of arſenic, mercurius dulcis, and ſome quickſilver, are obtained. The ſame thing happens with a mixture of orpiment and corroſive ſublimate.

946 Butter of arſenic is not obtained by this proceſs.

947 With copper.

27. Arſenical acid diſſolves copper by a digeſting heat. The ſolution is of a green colour: a quantity of light blue powder is depoſited, and attaches itſelf to the copper. This powder conſiſts of the acid of arſenic and calcined copper. On mixing two parts of dry acid of arſenic, in fine powder, with one of filings of copper, and diſtilling the mixture, ſome arſenic roſe into the neck, and the maſs melted and turned blue. On boiling it with water, the ſolution was ſimilar to one made directly from acid of arſenic and copper. A little copper remained in the bottom of the retort, which was tinged with brown, red, and yellow ſpots, inſoluble in any menſtruum. The ſolutions of this metal are not precipitated by arſenical acid, but the acetous ſolution is. Neutral arſenical ſalts throw down a blue precipitate, which by expoſure to a ſtrong fire, turns brown and covers the inſide of the containing veſſel with a yellow enamel. On mixing the ſcoria in a fine powder with a little lampblack, ſome fine regulus of arſenic ſublimed, and the copper in the reſiduum was reduced.

948 With iron.

28. With iron the acid of arſenic forms a gelatinous ſolution, which by expoſure to the air grows ſo thick that in two hours time it will not flow out at the mouth of a phial. With alkali of tartar a whitiſh green powder is thrown down; which being edulcorated and diſtilled in a glaſs retort, yields ſome arſenic, and leaves a red ochre behind. On diſtilling four parts of arſenical acid with one of iron filings, the maſs effervesced ſtrongly towards the end; and when it became dry, took fire in the retort upon increaſing the heat, when both arſenic and regulus of arſenic were ſublimed. The reſiduum was black, friable, and contained but little acid of arſenic; the retort was covered with yellowiſh brown ſpots. Solutions of iron in mineral acids are not precipitated by acid of arſenic, but the acetous ſolution lets fall a dark brown powder. All the ſolutions are precipitated by the arſenical neutral ſalts, the precipitates by a ſtrong fire, converted into black ſcoriæ; which mixed with powdered charcoal, and calcined, yield copious vapours of arſenic, and are afterwards attracted by the magnet.

949 With lead.

29. Lead digeſted with arſenical acid turns black at firſt, but in a few days is ſurrrounded with a light greyiſh powder, containing ſome arſenic which may be ſeparated by ſublimation. On diſtilling one part of ſhavings of lead with two of dry acid of arſenic, the lead was diſſolved, the maſs flowed clear, and a little arſenic roſe into the neck of the retort. A milky glaſs was found in the bottom, which by boiling in diſtilled water, let fall a quantity of white powder, the ſuperfluous acid being diſſolved in the water; the edulcorated powder yielded regulus of arſenic by diſtillation with charcoal. Solutions of lead in nitrous and muriatic acids are precipitated by arſenical acid.

950 With tin.

30. Tin digeſted with acid of arſenic becomes firſt black, then is covered with a white powder, and afterwards becomes gelatinous. One part of tin filings diſtilled with two of acid of arſenic, took fire as ſoon as the retort became red-hot, and immediately after both arſenic and a little regulus were ſublimed. The tin was diſſolved into a limpid liquor, which became milky when cold.—By waſhing in water, a quantity of white powder was ſeparated, inſoluble in any acid, and containing very little of that of arſenic.

251 With zinc.

31. Arſenical acid diſſolves zinc with effervescence. The metal grows black, and the tranſparency of the acid is deſtroyed by a quantity of black powder. This powder edulcorated, dried, and put on an iron plate heated nearly red-hot, emits a blue flame and white arſenical ſmoke in the dark, leaving behind a white powder; thus manifeſting itſelf to be moſtly regulus of arſenic. One part of filings of zinc diſtilled with two of acid of arſenic, took fire in the retort with a very bright flame, and burſt the veſſel with an exploſion. Some regulus of arſenic and flowers of zinc were found in the neck.

952 With biſmuth.

32. Biſmuth digeſted with acid of arſenic is covered with a white powder; water precipitates the ſolution, and the precipitate conſiſts of calcined biſmuth and acid of arſenic. On diſtilling one part of the biſmuth with three of arſenical acid, the maſs melted, the metal was calcined, but remained undiſſolved in the bottom of the veſſel; a little arſenic roſe into the neck; and after the retort became cool, water was poured on the reſiduum, which diſſolved the acid, but the calx of biſmuth remained unchanged. Solution of this ſemimetal in the acid of nitre was precipitated by arſenical acid. This precipitate, as well as the calx, are very difficult of fuſion, but on adding a little powdered charcoal, the mixture inſtantly melts, the arſenic goes off in vapours, and the biſmuth is reduced.

953 Regulus of antimony.

33. With regulus of antimony a quantity of white powder is produced by digeſtion, and the clear ſolution is likewiſe precipitated by dropping it into pure water. This powder is ſoluble only by muriatic acid, and may be precipitated again by the addition of water. One part of regulus of antimony diſtilled with three parts of arſenical acid, took fire as ſoon as the maſs melted, and regulus of arſenic with a red matter were ſublimed; a little volatile ſulphureous acid came over into the receiver. On boiling the reſiduum in water, the acid was diſſolved, a white ſhining powder remained behind, which on being mixed with charcoal powder and diſtilled, an ebullition took place, ſome regulus of arſenic roſe into the neck of the retort, and the antimony was reduced. Butter of antimony was not precipitated by the pure acid, but very readily by the arſenical ſalts. Acetous and tartareous ſolutions of glaſs of antimony are preciptated by arſenical acid



34. Cobalt

Acid of arsenic and its combinations.

954 With cobalt.

34. Cobalt is partially dissolved, and the solution assumes a rose-colour; on putting the whole mass into a retort, distilling off the liquid, and then augmenting the fire, the mass melted, and a little arsenic was sublimed. The residuum when cold had a semitransparent violet colour. On pouring water upon it, and putting it on hot sand, the acid was dissolved, the violet colour disappeared, and the solution assumed a dark-red colour. The bottom of the retort had a blue tinge, which could not be taken off. Solutions of cobalt in mineral acids are readily precipitated by the arsenical neutral salts. The precipitate is of a rose-colour, but melts with difficulty into a dark blue scoria.

955 With nickel.

35. Nickel, with acid of arsenic, assumes a dark green colour, and lets fall a green powder containing arsenic in substance, which may be separated from it by a gentle heat. One part of nickel distilled with two of dry arsenical acid, melted with some appearance of inflammation, yielding some arsenic at the same time. The mass was yellow, with a number of grey elevated streaks upon it, which appeared like vegetation, and were formed during the distillation. On boiling the yellow mass in water, the acid was dissolved, leaving a yellow powder behind; which, when treated with charcoal-powder, yielded regulus of arsenic, but was not reduced itself. The solutions of nickel in acids are not preciptated by arsenical acid, nor even that in vinegar, but the neutral arsenical salts throw down a whitish green powder.

956 With manganese.

36. Manganese in its natural state is dissolved only in small part; but when phlogisticated it dissolves readily and totally; though, whenever the acid arrives at the point of saturation, the solution coagulates into small crystals.

957 With regulus of arsenic.

37. Regulus of arsenic digested with its own acid soon becomes covered with a white powder, which is arsenic in substance. On distilling one part of the regulus with two of the acid, the former sublimed and the latter melted. If small pieces of regulus of arsenic be gradually added to the acid of arsenic in fusion, an inflammation takes place, and arsenic is sublimed.

2d 957 Strange phenomenon of arsenic with terra foliata tartari.

On distilling a mixture of equal parts of terra foliata tartari and arsenic, a limpid liquor like water first came over, smelling strongly of garlic; on changing the receiver, a liquor of a brownish red colour was collected, which filled the receiver with a thick cloud, emitting an intolerable smell of arsenic. On pouring this upon a filter, hardly a few drops had passed when a very thick stinking smoke suddenly arose as high as the cieling of the room; an ebullition ensued towards the edge of the filtering-paper, and a fine rose-coloured flame broke out, that lasted for some moments.

### § 13. *Of the Acid of* MOLYBDÆNA.

958 How to reduce molybdæna to powder.

We owe this, as well as the succeeding acids to the industry of the late Mr Scheele. The substance from which he extracted it is named by Cronstedt *molybdæna membranacea nitens*.—As this substance is of a flaky nature, and incapable of pulverization by itself, our author mixed some pieces of vitriolated tartar along with it in a glass mortar; by the attrition of which it was at last reduced to a fine powder, and which was afterwards freed from the vitriolated tartar by washing with hot water. He then treated this powder with all the known acids, but found none of them to have any effect upon it excepting those of arsenic and nitre. No sensible effect was perceived from the acid of arsenic until the water was evaporated; after which, by increasing the fire, a little yellow orpiment was sublimed in the neck of the retort, and some sulphureous acid passed over into the receiver. On pouring two parts of concentrated nitrous acid upon one part of powdered molybdæna, the mixture was scarce warm in the retort, when it passed altogether into the recipient with great heat, and in the form of dark red vapours. Had the quantity been larger, he had no doubt that it would have taken fire; for which reason the experiment was repeated with diluted nitrous acid. Six ounces of diluted nitrous acid being poured on an ounce and a half of powdered molybdæna, no effect was perceptible till the liquor began to boil; after which a great number of red elastic vapours began to appear, and the mixture swelled considerably. The distillation being continued to dryness, the residuum appeared of a grey colour; the same quantity of nitrous acid was poured on, and the process repeated, when the residuum was whiter; and on still repeating the operation a fourth and fifth time, the remaining powder became at last as white as chalk. This residuum, after being edulcorated with hot water, was quite tasteless and insipid when dry. The limpid liquor which ran from it being evaporated to half an ounce, first assumed a fine blue colour, and then grew thick. On being examined, it was found to contain some iron, and was otherwise chiefly acid of vitriol. The colour disappeared on diluting the acid with water.

Acid of molybdæna and its combinations.

959 Effects of the acid of arsenic upon it.

960 Violent action of concentrated nitrous acid upon this substance.

961 Acid of molybdæna obtained by fire alone.

The white powder just mentioned is the true acid of molybdæna, and may be obtained by the help of fire alone. A small piece of molybdæna exposed on a silver plate to the blow-pipe, makes a beautiful appearance, when the white vapours attach themselves to the plate in the form of small shining scales, in the direction of the flame. This white sublimate becomes blue whenever it is in contact with the blue flame; but changes to white whenever the point of the flame is directed against it. An ounce of powdered molybdæna was mixed with four ounces of purified nitre, and detonated in a crucible heated thoroughly red hot. The mass thus obtained was of a reddish colour. On dissolving it in water, the solution was clear and colourless. A small quantity of red powder fell to the bottom of the vessel; which, when dry, weighed 11 grains, and showed itself to be an iron ochre. By evaporation vitriolated tartar and nitre were obtained; but a good deal of lixivium remained, which refused to crystallize, though no mark of superfluous alkali remained. It was then mixed with some water, to which diluted acid of vitriol was added, until no more precipitate fell. The white powder which precipitated weighed three drachms; but if too much acid be added, the precipitate will be redissolved, and the water itself retains a part of it in solution. A precipitate is likewise obtained by means of nitrous or muriatic acid.

962 Its chemical properties.

The precipitate thus obtained, like those which result from the two former processes, is the true acid of molybdæna, and has the following chemical properties.



1. The

Acid of molybdæna and its combinations.

1. The solution reddens lacmus, coagulates a solution of soap, and precipitates hepar sulphuris. 2. If this solution be boiled with the filings of any of the imperfect metals, it assumes a bluish colour. 3. By the addition of a little alkali of tartar, the earth becomes soluble in greater quantity in water; and after evaporation shoots into small confused crystals. 4. Under the blow-pipe this earth is soon absorbed by charcoal; but when placed on a silver plate it melts, and evaporates with the same phenomena as molybdæna itself. 5. By the addition of alkali, the earth is deprived of its property of being volatilized in the fire. 6. The solution, whilst hot, shows its acid power more evidently than when cold, and tinges lacmus of a deeper colour. It effervesces with chalk, with magnesia, and with earth of alum; with all of which it forms salts very difficult of solution in water. 7. It precipitates, from the nitrous acid, silver, quicksilver, and lead, as also lead dissolved in marine acid. These precipitates are reduced on burning charcoal, and the melted metal runs into the pores. Corrosive sublimate is not precipitated; neither are the solutions of the other metals. 8. Terra ponderosa is also precipitated from the nitrous and marine acids; and the precipitate is soluble in a large quantity of cold water. None of the solutions of the other earths are precipitated. 9. Fixed air is also expelled by this acid from the fixed and volatile alkalies, and forms with them neutral salts which precipitate all other metallic solutions. Gold, corrosive sublimate, zinc, and manganese, are precipitated in form of a white powder; iron and tin, from their solution in marine acid, of a brown colour; cobalt of a rose colour; copper of a blue; the solutions of alum and quicklime, white; and if the ammoniacal salt formed by the earth of molybdæna and volatile alkali be distilled, the earth parts with its alkali in a gentle heat, and remains in the retort in form of a grey powder. 10. Concentrated vitriolic acid dissolves a great quantity of this earth by means of heat. The solution acquires a fine blue colour; which, however, disappears on being heated, or by diluting the acid with water. In a stronger heat the acid flies off, leaving the earth unaltered behind. This solution becomes thick on cooling. 11. The nitrous acid has no effect upon the earth of molybdæna. 12. Boiled with the muriatic acid it dissolves in considerable quantity; and, on distilling the mixture to dryness, a dark-blue residuum remains. On increasing the heat, white flowers arise, with a little blue sublimate, and a smoking muriatic acid is found in the receiver. The residuum is of a grey colour. These flowers are only the earth of molybdæna volatilized by means of the muriatic acid, and therefore manifests the same properties. 13. If one part of this earth be distilled with two parts of vitriolated tartar, a little vitriolic acid passes over, at least when the heat is very strong; and the remaining earth is more soluble in water than before. 14. With two parts of nitre it expels, by means of distillation, a strong nitrous acid; the residuum dissolved in water is a neutral salt which precipitates all metallic solutions, and is similar to that formed by a direct union of the acid and fixed alkali. 15. Distilled with two parts of pure common salt, the acid is expelled in a smoking state, and white, yellow, and violet-coloured flowers arise, which become moist in the air, and when sprinkled on metals give them a blue colour. These flowers, as has been already remarked, are only the acid of molybdæna volatilized by that of sea salt.

Acid of molybdæna and its combinations.

963 Is capable of uniting with phlogiston.

The blue colour acquired by this earth on the contact of flame, also in the moist way in some cases, shows that it is capable of contracting an union with the phlogiston. To reduce this to certainty, Mr Scheele dissolved some of the earth of molybdæna in boiling water, with the addition of a little alkali. Into this solution he poured some drops of muriatic acid, and divided it into several parts, into each of which he put filings of several metals. The solutions soon acquired a bluish colour, which grew deeper and deeper; and in an hour's time, during which the bottle was now and then shaken, the liquor assumed a fine dark blue. That this colour depends on phlogiston, he infers from the following circumstances: 1. If, instead of the metals themselves, you take their calces, no blue colour is produced. 2. If there be dropped into the blue solution a few drops of acid of nitre, and the solution be then put into a warm place, the colour disappears. It is therefore no matter of surprise, that both silver and quicksilver should be attacked, since a double elective attraction takes place; the muriatic acid uniting with the metallic calx, and the earth of molybdæna with the phlogiston of the metals. Gold, however, is not attacked in this way. 3. Too great a quantity of muriatic acid produces not a blue but a yellowish colour, which at last turns brown if the mixture be digested; but on adding this solution to a solution of the earth of molybdæna, a blue colour as usual is produced. 4. Lixivium sanguinis, in which the acid prevails, throws down the earth of a brown colour, and the infusion of galls of a dark brown.

964 Shows no sign of containing any metal.

The acid of molybdæna, treated with various fluxes, and with charcoal, shows no signs of containing any metallic matter. Moistened with oil-olive, and committed to distillation in a strong fire, it did not sublime, but remained in the retort in the form of a black powder; which, on being calcined in a crucible, sublimed in white flowers as usual. On inverting another crucible into the former, and luting the juncture, the earth remained unchanged and of a black colour, without any sign of fusion. This black powder did not dissolve in boiling water, nor even with alkali, which on other occasions so readily dissolves it; but when mixed with a triple quantity of salt of tartar, a great effervescence ensued; the produce was a neutral salt resembling that formed by the direct union of the acid and alkali.

965 Properties of the acid obtained by nitre.

The earth of molybdæna, procured by nitre, requires much less water for its solution; it does not expel the acid from vitriolated tartar; is more easily fused, and does not sublime in an open crucible. When fused with charcoal-powder, it affords a solution with water, containing a neutral salt, which precipitates all others. The reason of these differences is, that it contains a portion of alkali, though it be ever so frequently purified by solution and crystallization. That this is the case we know from the following experiments: 1. If to a solution of the nitrous earth of molybdæna we add some nitrous acid, the latter attacks the alkali, and the greatest part of the dissolved earth is precipitated. This, however, does not happen, except by long boiling. 2. The neutral salt obtained by fusion proves the same. This neutral salt is produced in the following manner. The earth which contains

Acid of molybdæna and its combinations.

tains only a small quantity of alkali operates as an acid, as appears from its changing the colour of lacmus to red; but the alkali prevents as much earth from entering into it as is necessary to its saturation with phlogiston; for the acid of molybdæna has a greater attraction for alkali than for phlogiston. The charcoal which remains after lixiviating the compound of acid of molybdæna and charcoal, yields vapours in an open crucible, and gives a sublimate containing the phlogisticated earth of manganese. This alkali fixes the earth in the open air; and hence we see also the reason why this earth does not expel the acid from vitriolated tartar; for its attraction for the alkali must diminish in proportion as it comes nearer the point of saturation; and as the pure earth contains no alkali, it attracts a little from the vitriolated tartar; and consequently there can appear but a slight vestige of vitriolic acid. This small quantity of acid likewise occasions its more easy solubility in water.

966 Molybdæna recomposed by uniting its acid with sulphur.

The pure acid of molybdæna recomposes that substance by being combined with sulphur. Mr Scheele having mixed some very fine powder of this earth with three parts of sulphur, and committed the mixture to distillation in a glass retort, the receiver was filled with the superfluous sulphureous vapours, which had also the fetid smell of volatile spirit of sulphur. In the retort a black powder remained, which on every chemical trial was found to be a true molybdæna; so that there is now no doubt of this substance being composed of a particular kind of acid united to sulphur.

## § 14. *Of the Acid of* Lapis Ponderosus, Tungsten, *or* Wolfram.

967 This substance considered as a metallic earth by Mr Bergman.

This substance has been analysed both by Mr Scheele and Mr Bergman, though the former has the merit of discovering the acid contained in it; which the latter considers, as well as the earth of molybdæna, not as truly acid, but as metallic earths. Mr Scheele's experiments for analysing this substance were as follow:

968 Scheele's method of analysing it.

1. On one part of finely powdered tungsten were poured two parts of concentrated acid of vitriol. By distillation the acid passed over unchanged; the residuum, which was of a bluish colour, after being boiled for a short time, and the liquor filtered off, deposited some vitriolated lime or gypsum by standing. 2. Twelve scruples of common nitrous acid, or pure aquafortis, being poured on two of finely powdered tungsten, no effervescence ensued; but on exposing the mixture to a strong digesting heat, it assumed a citron yellow colour. The acid was then poured off into another phial, and the yellow powder edulcorated with water. 3. On this yellow powder eight scruples of caustic volatile alkali were poured, and the phial exposed to heat; on which the yellow colour instantly vanished, and the powder became white. This solution was in like manner put into a separate phial, and the powder edulcorated; and as the matter was sensibly diminished by these operations, they were alternately repeated, till at length the whole was dissolved, excepting three grains, which seemed to be siliceous earth. The same effects ensued on treating this substance with muriatic acid, only the solution was of a deeper yellow colour. 4. The solutions made in the foregoing manner with nitrous acid being all mixed together, some drops of phlogisticated alkali were added; by which about three grains of Prussian blue were precipitated. 5. The mixture was then saturated with caustic volatile alkali; but as no precipitate appeared, a solution of fixed alkali was added, which threw down two scruples and five grains of white earth of a mild calcareous kind. On adding some nitrous acid to the extracts made by volatile alkali, a white powder was precipitated, which, on edulcoration, proved to be the true acid of tungsten.

Acid of lapis ponderosus and its combinations.

969 Effects of heat upon it.

On treating tungsten with a strong heat in the dry way, the following appearances took place: 1. One part of tungsten mixed with four of alkali of tartar was melted in an iron crucible, and then poured out on an iron plate. Twelve times its weight of boiling water being then poured upon it, a white powder subsided to the bottom, which dissolved in a great measure in nitrous acid. 2. The undissolved part of the powder was tried; and being again mixed with four parts of alkali, was melted as before: and the mass being also dissolved in water, and nitrous acid poured on the residuum, only a very small portion of grey powder was left undissolved. 3. The ley being saturated with nitrous acid, grew thick by the precipitation of a white powder; which was afterwards washed with cold water and dried, and then proved to be the same acid of tungsten with that already described. The solution in nitrous acid precipitated with fixed alkali gave a white precipitate, which was found to be calcareous earth.

970 Its chemical properties.

The properties of the acid of tungsten are, 1. Under the blow-pipe it became first of a reddish yellow colour, then brown, and at last black. It neither smoked nor gave any signs of fusion. 2. With borax it produced a blue, and with microcosmic salt, a sea-green glass. 3. Boiled with a small portion of the nitrous or marine acids, the powder becomes yellow, and with the acid of vitriol bluish. 4. On saturating a solution of the acid with fixed alkali, a neutral salt in very small crystals is obtained. 5. With volatile alkali this acid forms an ammoniacal salt, shaped like the points of small pins. On distillation the alkali separates in a caustic state, the acid remaining behind in the retort in form of a dry yellow powder. On mixture with a solution of lime in spirit of nitre, a double elective attraction takes place, the acid of tungsten uniting itself with the lime, and that of nitre with the volatile alkali. 6. With magnesia the acid of tungsten forms a salt very difficult of solution. 7. It produces no change on solutions of alum or lime, but decomposes a solution of terra ponderosa in acetous acid, and the compound is totally insoluble in water. 8. It precipitates of a white colour solutions of iron, zinc, and copper, in the vitriolic acid; silver, quicksilver, and lead, in that of nitre; and lead in the acid of sea-salt. Tin combined with the same acid is thrown down of a blue colour; but corrosive sublimate and solutions of gold undergo no change. 9. On calcining the acid of tungsten in a crucible, it loses its solubility in water. 10. It turns black by calcination with inflammable matters and with sulphur, but in other respects continues unaltered. 11. Solution of hepar sulphuris is precipitated of a green colour by this acid, and the phlogisticated alkali white; the latter precipitate being soluble in water. On the addition of a few drops of muriatic acid to a solution of the acid

Acid of lapis ponderosus and its combinations.

acid of tungsten in water, and spreading the liquor on polished iron, zinc, or even tin, it acquires a beautiful blue colour; and the same thing happens when these metals are put into the acid. 12. It differs from the acid of molybdæna in not being volatile in the fire; in having little attraction for phlogiston or sulphur; in turning lime yellow, and forming an insoluble compound with it as well as with ponderous earth. It has also a stronger attraction for lime than the acid of molybdæna; for if a combination of lime and acid of molybdæna be digested in a solution of the ammoniacal salt formed by uniting the acid of tungsten with volatile alkali, the latter expels the former, and produces regenerated tungsten. 13. By uniting the acid of tungsten to a calcareous earth, a regenerated tungsten is constantly procured.

971 Differences betwixt the acid of tungsten and molybdæna.

972 Bergman's opinion concerning the acids of tungsten and molybdæna.

Mr Bergman observes, that the acid earth of tungsten is nearly allied to that of molybdæna; and both are in a state much resembling that of white arsenic. "It is well known (says he) that arsenic, in its semimetallic state, is nothing but a peculiar acid saturated with phlogiston; and that the white calx is an intermediate state between acid and metal, containing just phlogiston enough to coagulate the acid, but remaining still soluble in water, and showing signs of acidity. If a conclusion from analogy be admissible, all the other metals should consist in a combination of the same nature of the different radical acids, which with a certain quantity of phlogiston are coagulated to a dry earthy substance; and on full saturation are reduced to the state of complete metals."

973 Why he supposed the acids to be metallic earths.

The reasons which induced Mr Bergman to suppose that the acids in question are metallic earths, are as follow: 1. They both show a striking resemblance to white arsenic in form, in producing effects like acids, and in their difficult solubility in water. 2. Their specific gravity; that of arsenic being 3750, the earth of molybdæna 3460, and the acid of tungsten 3000. 3. Their precipitation with phlogisticated alkali; a property hitherto deemed peculiar to metallic calces. Arsenic also, properly dissolved in muriatic acid, gives, with the phlogisticated alkali, a precipitate soluble in water, in the same manner as the acid of tungsten. 4. From their property of tinging vitreous matters; which, as well as that of precipitating with the phlogisticated alkali, is reckoned to be a peculiar property of metals. The acid of tungsten produces by itself some effervescence with mineral alkali. With microcosmic salt it produces a globule at first of a light blue; more of the acid makes it a dark blue; but still it remains free from redness by refraction. A further addition makes it brown. Borax requires a slight tinge of blue, and with more of the acid becomes of a yellowish brown colour; but remains transparent, provided no further addition be made. This ultimate brown colour cannot be driven off either by nitre or the point of the flame urged by a blow-pipe. Acid of molybdæna is no less powerful; for with microcosmic salt it produces a beautiful green colour: borax well saturated with it appears grey when viewed by the reflected rays, but of a dark violet by the refracted.

### § 15. *Of the Acid of Milk.*

It is universally known, that in the summer-time milk grows sour and thick in a few days, and that this sourness continues for some time to increase. It is strongest after a fortnight has elapsed; after which, if the whey be filtered and evaporated to one-half the quantity, a few curds will still settle to the bottom. By saturating the whey with volatile alkali, a small quantity of animal earth precipitates; and the same thing takes place on the addition of lime-water. On the addition of a small quantity of acid of tartar, the latter soon becomes partially saturated with vegetable alkali, and is converted into tartar. Thus the acid of milk besides its proper acid part, contains animal earth and vegetable alkali in a loose state, and which is attracted by the acid of tartar; besides all these it has also a small quantity of the same alkali saturated with muriatic acid. It is no easy matter to separate these substances from one another; because the acid is not sufficiently volatile to rise in distillation by a gentle heat, nor are its principles sufficiently fixed to bear the action of a strong fire. With the one therefore it remains almost entirely in the retort, and with the other it is destroyed. Mr Scheele therefore used the following process.

Acid of milk and its combinations.

974 Milk most strongly acid after standing a fortnight.

975 Component principles of sour whey.

976 Scheele's method of procuring the pure acid of milk.

He evaporated sour whey till only one-eighth part remained; when the cheesy part being totally separated, he strained the acid; and in order to obtain the animal earth, saturated the liquor with lime, diluting the solution with a triple quantity of water. In order to separate the lime, he employed the acid of sugar, which has a stronger attraction than any other for lime. This earth therefore being separated, the matter was evaporated to the consistence of honey, and highly rectified spirit of wine poured upon it to dissolve the acid part; which being accomplished, the other saline substances were left by themselves: and, lastly, the acid solution being diluted with pure water, and the spirit separated by distillation, the pure acid remained in the retort.

977 Properties of this acid.

The properties of the acid of milk are, 1. Evaporated to the consistence of a syrup, it yields no crystals; and when evaporated to dryness, it deliquesces. 2. By distillation it yields first water, then a weak acid like spirit of tartar; afterwards some empyreumatic oil, with more of the same acid, fixed air, and inflammable air; in the retort was left a fixed coal. 3. By saturation with fixed vegetable alkali it yields a deliquescent salt, soluble in spirit of wine. 4. A salt of a similar kind is obtained by combining it with mineral alkali. 5. With volatile alkali a deliquescent salt is produced, which by distillation yields a great deal of its alkali before the acid is destroyed by heat. 6. It forms deliquescent salts with terra ponderosa, lime, and clay; but with magnesia it forms small crystals, which, however, are again deliquescent. 7. It has no effect either by digestion or boiling on bismuth, cobalt, regulus of antimony, tin, quicksilver, or gold. However, after digestion with tin, it precipitated gold from its solution in aqua-regia, in the form of a black powder. 8. It dissolves iron and zinc, producing inflammable air during the solution. The liquor produced by the dissolution of iron was brown, and yielded no crystals; but the solution of zinc crystallizes. 9. Copper dissolved in this acid communicates to the liquor first a blue, then a green, and then a dark blue colour, without crystallizing. 10. Lead was dissolved after some

Acid of milk and its combinations.

fome days digeftion; the folution had a fweet aftringent tafte, and would not cryftallize. A fmall quantity of white matter fell to the bottom, which on examination was found to be vitriol of lead.

978
It feems to be of the acetous kind.

"From thefe experiments (fays Mr Scheele) it appears, that the acid of milk is of a peculiar kind; and though it expels the vinegar from the acetated vegetable alkali, yet it feems deftined, if I may fo fpeak, to be vinegar; but from the want of fuch fubftances as, during fermentation, produce fome fpirituous matter, it feems not to be volatilized, though a portion of it indeed arrives at this point, and really becomes vinegar: for without a previous fpiritous fermentation, or without brandy, there never arifes any vinegar. But that the milk enters into a complete fermentation though there be no fign of brandy prefent, appears from the following experiment: If a bottle full of frefh milk be inverted into a veffel containing fo much of the fame liquor that the mouth of the bottle reaches below the furface of the latter, and if you expofe this bottle to a degree of heat a little greater than our fummer, you will find, in the fpace of 24 hours, that the milk is not only coagulated, but in part expelled out of the bottle; and that in a couple of days afterwards, the aerial acid extricated from the milk will have expelled the greater part of it. It was faid above, that the acid of milk cannot be converted into vinegar, from the want of fuch fubftances as during fermentation produce brandy; which appears to be evident from this: If to a kanne of milk you add five fpoonfuls of good brandy, and expofe the veffel, well corked, in fuch a manner, however, that you now and then give vent to the air developed during fermentation, you will find in a month, fooner or latter, that the whey will be changed into good vinegar, which, ftrained through a cloth, may be kept in bottles."

979
Milk capable of complete fermentation.

2d 979
Converted into vinegar.

980
Acid of fugar of milk how procured.

The acid of fugar of milk is confiderably different from that juft now defcribed. To procure it, Mr Scheele poured 12 ounces of diluted nitrous acid on four ounces of finely powdered fugar of milk contained in a glafs retort, to which a receiver was adapted. The retort was placed in a fand-bath, and as foon as the mixture acquired a certain degree of heat, it began to effervefce violently; for which reafon, the retort and receiver were taken away from the fire. The mixture, however, continued to grow hotter and hotter, with a great emiffion of dark red vapours continually increafing, for half an hour. A confiderable quantity of nitrous air and aerial acid were extricated during that time. Care muft be taken, therefore, to have the retort and receiver both of a fufficient fize, and not to make the luting too tight. When the effervefcence had fubfided, the retort was again placed in the fand-bath, and the nitrous acid thus diftilled off till the mafs acquired a yellowifh colour; on which the retort was immediately taken away from the fire. In two days time the folution feemed to have undergone no remarkable change, nor was there any appearance of cryftals. Eight ounces more of the fame nitrous acid were therefore added, and the whole expofed to the fame degree of heat as before. When the mafs grew warm, another effervefcence, though weaker than the former, enfued; the yellow colour difappeared, and the nitrous acid was again abftracted, till the folution, which had been rendered opaque by the appearance of a white powder in it, affumed a yellowifh colour, on which the retort was again removed from the fand. After it was grown cool, the mafs in the retort was found to be infpiffated; it was rediffolved in eight ounces of water, and filtered. Seven and a half drachms of white powder remained on the filter; the folution which paffed through the filter was very acid. It was evaporated to the confiftence of a fyrup, four ounces more nitrous acid poured upon it, and the evaporation repeated in a fand-heat. After the whole was cool, fome fmall long acid cryftals were found, together with a fmall quantity of white powder which was feparated from it, and fome more nitrous acid poured on the remaining mafs, and on evaporation, more fuch cryftals made their appearance. The fame procefs was repeated feveral times; by which means the whole mafs was at laft changed into fuch cryftals, and weighed about five drachms, fhowing in every refpect the fame phenomena produced by acid of fugar. The white powder, weighing feven and a half drachms, was the true acid of fugar of milk; and its properties are,

981
Properties of this acid.

1. It burns in a red hot-crucible like oil, without leaving behind it any mark or afhes. 2. It diffolves in boiling water in the proportion of one of falt to 60 of the liquid. 3. One fourth part of the diffolved powder feparates from the liquid on cooling, in form of very fmall cryftals. 4. Half an ounce of the falt was diffolved in a glafs veffel in 30 ounces of boiling water, and the folution filtered when cold. It had a fourifh tafte, reddened the tincture of lacmus, and effervefced with chalk. 5. Two drachms of the falt expofed to an open fire in a glafs retort, melted, grew black, and frothed very much; a brown falt was found fublimed into the neck of the retort, which fmelled like a mixture of falt of benzoin and falt of amber, eleven grains of coal remaining in the retort. The receiver contained a brown liquid without any mark of oil, fmelling like the fublimed falt. It contained alfo fome of the falt diffolved, which was feparated from it by a gentle evaporation. The fublimed falt weighed 35 grains, had a four tafte, and was eafily foluble in fpirit of wine, but with more difficulty in water, and burned in the fire with a flame. 6. Concentrated vitriolic acid, diftilled with this falt, became very black, frothed much, and decompofed the falt entirely. 7. Acid of fugar of milk, gradually added to a hot folution of alkali, occafioned an effervefcence and coagulation in confequence of the formation of a vaft number of cryftals, which require eight times their weight of water to diffolve them, and feparate again in a great meafure from the liquid on cooling. The fame phenomena took place with the mineral alkali, only the falt was fomewhat more foluble, requiring only five times its weight of water for folution. If to a folution of it a folution of alkali of tartar be added, a number of fmall cryftals will foon be formed at the bottom of the veffel, on account of the greater attraction of this acid with the vegetable alkali. 8. With volatile alkali it forms a kind of fal ammoniac, which, after being gently dried, has a fourifh tafte. By diftillation, the volatile alkali is firft feparated, the lime-water precipitates, and the refiduum yields the fame products by diftillation as the pure acid. 9. With all the earths, acid of fugar of milk forms infoluble falts.

Lithisiac acid and its combinations.

salts. If a solution of ponderous earth in muriatic or nitrous acid be dropped into a solution of acid of sugar of milk, the former is instantly decomposed, and the earth falls to the bottom in combination with the acid of saccharum lactis. The same phenomena take place with solutions of lime in the nitrous and marine acids; but solution of gypsum is not decomposed. The same also takes place with solutions of magnesia in vegetable or mineral acids, and with earth of alum; all of which are decomposed by the neutral salts abovementioned. 10. The solution of this acid, by reason of the small quantity dissolvable in water, has no sensible effects on metals in their perfect state; but when they are reduced to calces, it then acts upon them, and forms salts, very little or not at all soluble in water. Silver, mercury, and lead are precipitated in form of a white powder; blue, green, and white vitriol, as well as manganese combined with acid of vitriol, are not precipitated; but all metallic solutions are precipitated by the neutral salts.

### § 16. *Of the* Lithisiac *Acid, or Acid of the human Calculus.*

982 Calculi all of the same nature.

The calculi examined by Mr Scheele, with a view to discover their constituent parts, were, as he informs us, all of the same nature, whether flat and polished, or rough and angular. A small quantity of calculus in powder was put into a retort, and some diluted vitriolic acid, poured upon it. The powder was not affected by a digesting heat; however, it was dissolved when the humidity was abstracted by distillation. After the dissipation of the acid, a black coal was left in the retort, and the vitriolic acid which had passed into the receiver was become sulphureous. The marine acid, whether diluted or concentrated, had no effect upon the calculus, not even when boiled with it. The nitrous acid diluted, or aquafortis, had some effect on the calculus, even when cold. On the application of heat, an effervescence ensued with red vapours, and the calculus was dissolved. Repeating the experiment in a retort with lime-water, the latter was precipitated. The solution of calculus is acid, though the menstruum be boiled with a superabundant quantity of powder, so that there may remain a portion of it un-

983 Properties of the acid of calculus.

dissolved. It produces deep red spots on the skin in half an hour after it is applied; and if the saturated solution be a little more evaporated, it assumes of itself a blood-red colour, which however, disappears on dropping in a single drop of nitrous acid. Terra ponderosa is not precipitated by it from the muriatic acid; nor are metallic solutions sensibly changed. With alkalies it becomes somewhat more yellow when the alkali is superabundant. The mixture, in a strong digesting heat assumes a rose colour, and stains the skin in the same manner, without any sensation of burning. The mixture likewise precipitates metals of different colours; vitriol of iron, black; of copper, green; solution of silver, grey; corrosive sublimate, zinc, and lead, of a white colour. Lime water precipitates a white powder soluble in muriatic and nitrous acids without effervescence; and though there be an excess of precipitated powder, the solution will be acid. This white powder, therefore, is the acid of the calculus itself, the existence of which is also confirmed by Mr Bergman's experiments. The further analysis of this is related under the article Calculus, below.

Flowers of benzoin, &c.

### § 17. *Of the* Flowers *of* Benzoin, *Acid of* Lemons, *with other anamolous vegetable acids, and the resemblance which the vegetable acids in general bear to one another.*

984 Flowers of benzoin obtained by sublimation.

It has long been known, that the resinous substance, improperly called gum benzoin, yields by sublimation with a gentle heat a quantity of fine saline matter of a most agreeable odour, and slightly acid taste, called *flowers* of *benzoin*. Another method of obtaining this substance is by lixiviating the gum with water, and crystallizing the salt.

985 By lixiviation.

Mr Scheele, determined to try what quantity of the flowers could be obtained from the resin, found that, by sublimation, he was able to obtain from one pound of benzoin between nine and twelve drachms of flowers. By lixiviation the quantity obtained was considerably less than the former, owing to the saline particles being so much covered by the resin, that the water could not have sufficient access to dissolve them all.

986 Quantities obtained by both methods.

987 Attempts to procure all the flowers the resin is capable of yielding.

It was next attempted to procure all the flowers which the benzoin was capable of yielding. This was first done by boiling pounded chalk and benzoin in water, and then filtering the decoction; but no crystals appeared. On pouring some drops of vitriolic acid into the liquor, the salt of benzoin soon afterwards precipitated (for this salt, which is an acid, was united to the chalk); but the quantity of salt was no greater than that obtained by lixiviation.

988 Boiling with chalk insufficient;

Alkaline ley was next tried, and the solution saturated with an acid. Thus the salt of benzoin was obtained by precipitation; but here this inconvenience was met with, that the powder of benzoin ran together during the boiling, and floated on the surface like a tenacious resin.

989 And with alkaline ley.

990 Boiling with lime the best method.

One only method, therefore, remained to be tried, and that was to boil the benzoin with quick-lime; and as the particles of lime, by interspersing themselves betwixt those of the benzoin would prevent their running together, and lime has likewise the property of acting upon the resinous particles, this seems to be the best method of procuring the flowers of benzoin in the greatest quantity, and also of the best quality; and thus we may obtain from 12 to 14 drachms of flowers from a pound of benzoin.

991 Mr Scheele's receipt for preparing the flowers of benzoin by this method.

Mr Scheele's receipt for preparing them after this new method, is as follows: "Pour 12 ounces of water upon four of unslaked lime, and after the ebullition is over, add eight pounds (of 12 ounces each) of water; put then a pound of finely powdered resin of benzoin into a tinned pan, pour upon it first about six ounces of the lime-water abovementioned; mix them well together, and thus add all the rest of the lime-water in succession. The reason of adding the lime water thus by portions, is, that if it be poured in all at once, it will not mix with the benzoin, which will likewise coagulate and run together into a mass. This mixture must be boiled over a gentle fire for half an hour, agitating it constantly; then taking it from the fire, let it stand quiet for some time to settle, after which the clear liquor is to be poured off into a glass vessel. Pour then eight pounds of water more upon the lime in the vessel, and use this lime-water as before, repeating this process twice more, making four times

Flowers of benzoin, &c.

in all; and lastly, putting all the residuum together on a filter, pour hot water upon them. During this process, the calcareous earth of the lime-water combines with the acid of benzoin, and separates it from the resinous particles of this substance; but a small quantity of resin is dissolved by the lime-water, and gives it a yellow colour.

"All these liquors being mixed together and boiled down to two pounds, are then to be strained into another glass vessel. They are inspissated so far, because the superfluous water would hold a great quantity of the salt in solution; and a little of the resin being soluble in a large quantity of lime-water, but not in a small, falls to the bottom on the liquor being inspissated. When the liqour has become cold, after being strained the last time, add muriatic acid till the flowers be totally precipitated, which happens by reason of the stronger attraction of the marine acid for the calcareous earth. The precipitated coagulum is then to be put upon a filter; and, after being well dried, to be edulcorated sufficiently, by repeatedly pouring cold water upon it, when it must be dried with a gentle heat. As the water made use of for this purpose, however, is capable of dissolving a little of the salt of benzoin, it ought to be evaporated, and afterwards set to crystallize. In order to give this salt a shining appearance, let it be dissolved in a sufficient quantity, six, ounces, for instance, of water by gentle boiling; then strain it immediately, while yet warm, through a cloth, into a glass vessel which has been heated before; and thus a number of fine crystals will shoot as soon as the solution is grown cold. The water is then to be strained from the crystals, and the rest of the salt suspended in the water may be obtained by repeated evaporation and crystallization. In this method, however, a great quantity of the flowers are lost by reason of their volatility; it will therefore be more convenient to keep them in the form of their original precipitate, which is always in fine powder. Cloth answers best for the filtration of the hot solution: when blotting paper is used, the salt sometimes crystallizes in the filter, and obstructs it. The filteration itself might be omitted, were it not that about two grains of resin of benzoin remain united to the liquor, from whence it cannot be separated but by the operation just mentioned."——The properties of this salt as an acid are but little known. It has a most agreeable flavour; which, however, ceases as soon as it unites with calcareous earth, but is recovered again on being separated by any other acid.

992 Flavour of the flowers may be taken away and produced at pleasure.

With regard to the other vegetable acids, they may be divided into the essential, the fermented, and empyreumatic. The essential acids are pure, as exemplified in those of lemons, sorrel, and sorrel-dock; or but little altered by the admixture of other matters, as those of cherries, barberries, tamarinds, &c. In sweet fruits they are generally so much covered when ripe as scarce to be distinguished: however, these latent acids become more evident, partly in fermentation, and partly by dry distillation. By the former method, all flowers, excepting a few which bear cruciform flowers, are made to yield vinegar; and by dry distillation only a very few yield a volatile alkali.

993 Anomalous vegetable acids how divided.

994 Of the essential acids.

995 Empyreumatic acids.

The acid which passes over in dry distillation is scarce perceptible while the subject retains its natural form; but when once produced, has the same essential qualities with the other; whence it was naturally supposed that all vegetable acids are at bottom the same. Chemists, however, have been divided in their opinions on this subject; some supposing that the acid of sugar or of tartar is the basis, and others that vinegar is the basis of them all. In proof of this latter hypothesis, it has been urged, that the acid of lemons may be crystallized; of which we have the following account in Scheele's Essays. "The juice will not shoot into crystals by mere evaporation, even when thickened to the consistence of a syrup. This our author supposed to proceed from the great quantity of mucilaginous matter with which the juice abounds; for which reason he mixed the inspissated juice with strong spirit of wine which coagulated the whole: but even thus he could obtain no crystals by evaporation. He therefore employed the method used for procuring the pure acid of tartar, and which is formerly described. The lemon juice, while boiling, was saturated with pulverised chalk, and the compound immediately fell to the bottom in a form nearly resembling tartarised lime. To separate the acid, a quantity of oil of vitriol, equal in weight to the chalk employed, but diluted with ten times it weight of water was necessary. This mixture must be boiled in a glass vessel for a few minutes; and when grown cold, the acid is to be separated from the gypsum by filtration. In order to crystallize it, we must evaporate the whole to the consistence of a thin syrup; but great care is to be taken, lest any of the calcareous earth remain in the evaporated liquour: to determine which, a little of it is to tried with fresh oil of vitriol, which will throw drown the remainder: and in this case some more must be added to the whole quantity; for the least particle of lime remaining prevents the crystallization, while the superfluous quantity of oil of vitriol, if too much happens to be added, remains in the liquor. The crystals shoot equally well in a hot as in a cold temperature, which is very unusual."

996 Whether the acid of sugar or of tartar is the basis of vegetable acids.

997 Dr Crell's method of crystallizing the acid of lemons.

998 The crystallization prevented by the smallest particle of lime.

It is very remarkable that this crystallized salt of lemons cannot be converted into acid of sugar by means of that of nitre, though the extract of the juice itself may. Sour cherries afford acid of sugar, and another salt supposed to be tartar; and a kind of sugar may be obtained not only from roots of various kinds, but from fine raisins, and, as Dr Crell thinks, from expressed must; but whether the saccharine acid can be procured from this kind of sugar in equal quantity as from the common, or even whether it yields the same products with common sugar by dry distillation, is still a matter of doubt.

999 Salt of lemons cannot be converted into acid of sugar.

Pure acid of tartar yields on distillation *per se* an empyreumatic acid, and a coal consisting of oily particles and calcareous earth. Dr Crell therefore asks, May not the acetous acid be mere acid of tartar, which did not meet with alkaline salt and earth enough with which it might combine and become more fixed; but, on the contrary, attracted more subtile oily particles, and thus become more volatile? In distilling terra foliata tartari in the dry way, the acid of vinegar which enters its composition is almost entirely destroyed, only $\frac{1}{480}$th of pure acid being obtained, the residuum in the retort, as well as the rest of that which comes over into the receiver, being entirely alkakine; and the same

1000 Products of acid of tartar by dry distillation.

1001 Acetous acid almost entirely destoyed by fire.

Identity of the vegetable acids, &c.

ſame thing happens to the acid of tartar, the empyreumatic acid abovementioned being extremely weak. Mr Beaumé likewiſe informs us, that if any calcareous earth, egg-ſhells, for inſtance, be diſſolved in vinegar, and the cryſtallized ſalt be diſtilled, we obtain $\frac{23}{64}$ of a red and very fiery inflammable fluid, ſmelling like empyreumatic acetous ether, which reddens tincture of turnſole. Muſt, diſtilled before fermentation, yields only an empyreumatic acid reſembling ſpirit of tartar. The conjecture therefore ſeems reaſonable, that vinegar and tartar have for their baſis the ſame ſpecies of acid, which in the caſe of vinegar is combined with a

1002 Requiſites for bringing vinegar nearer the ſtate of tartar.

greater proportion of oil, and in tartar with more earth. To bring vinegar therefore nearer the ſtate of tartar, we muſt deprive it of its fine volatilizing phlogiſton, combine it with more fixed matter, and reſtore its groſſer oil. All this, however, is extremely difficult to be effected. Mr Weſtrumb, who attempted

1003 Mr Weſtrumb's unſucceſsful attempt.

it, added nitrous acid in various proportions, but could only produce a phlogiſtication of the latter, and dephlogiſtication of the vinegar; but as he could not think of any method of ſeparating the two acids from one another, he was unable to inveſtigate the pro-

1304 Dr Crell's opinion of the poſſibility of tranſmutation.

perties of vinegar thus dephlogiſticated. Dr Crell is of opinion, that this might have been done by vegetable alkali, lime, and terra ponderoſa. The nitrous acid, with vegetable alkali, would have ſhot into the ordinary hexangular cryſtals of nitre: the acetous acid would have formed a compound not eaſily cryſtallized, provided it had remained unchanged; and, though it had approached the nature of ſaccharine acid, would ſtill have formed a compound difficultly cryſtallizable. The effects of theſe acids, indeed, on lime, are directly oppoſite to what they are on terra ponderoſa. With the former, nitrous acid forms a liquor which can ſcarce be cryſtallized; with the latter it produces ſalts difficult to be diſſolved: while the acetous acid, with terra ponderoſa, forms deliqueſcent ſalts; with lime, ſuch as efflореſce in the air. But if the vinegar, by means of the operation already mentioned, had been made to approach towards the nature of acid of ſugar, tranſparent cryſtals would immediately have fallen by reaſon of the ſtrong attraction of this acid for lime. Dr Crell therefore recom-

1005 Method recommended by him for attempting the experiment.

mends the following method. Let nitrous acid be ſeveral times diſtilled off from vinegar; and when the former, upon being newly added, produces no more red vapours, ſaturate the liquor with lime or terra ponderoſa, ſeparating the ley, which will not ſhoot, from the cryſtals. The nature of the ſalt which does not contain nitrous acid, may be determined from the figure of its cryſtals, or from the effects of other ſalts in conſequence of a double elective attraction. We might likewiſe add freſh nitrous acid to the ſeparated ſalt, or to the whole mixture, without any ſeparation of the nitrous ſalt, till the earthy ſalt, which does not contain any nitrous acid, be ſaturated. The vinegar, if unaltered by the operation, would riſe on diſtilling the liquor; and if converted into ſaccharine acid, would not be diſlodged from lime by ſpirit of nitre. In like manner, diſtilled vinegar ſhould be ſaturated with chalk, the compound reduced to cryſtals, and then expoſed to as ſtrong a fire as it can bear without expelling the acid, in order to diſſipate ſome phlogiſtic particles. Let it then be diſſolved, filtered, and cryſtallized again; after which it may be treated with nitrous acid as above directed. "Perhaps (ſays Dr Crell), the acetous acid may by this combination acquire more fixity; ſo that the nitrous acid ſhall be able to produce a greater change. Should it paſs over again in the form of acetous acid unchanged, let it be combined once more with calcareous earth; and let the foregoing experiment be repeated, in order to try whether ſome ſenſible change will not enſue. Should this method fail, try the oppoſite; that is, endeavour to add more groſs phlogiſtic matter to the vinegar. Try to combine ſtrong vinegar, and that which has been diſtilled, with unctuous oils. Thus we might perhaps bring it nearer to tartar; and again, by means of nitrous acid, convert it into acid of ſugar. 1006

His attempts to prove that all the vegetable acids may be reduced to one.

In another diſſertation on this ſubject, Dr Crell undertakes to ſhow, that all the vegetable acids may be converted into one, and that this is contained in the pureſt ſpirit of wine. The following are adduced as proofs.

1. If the reſiduum of dulcified ſpirit of nitre be boiled with a large quantity of nitrous acid, care being taken at the ſame time to condenſe the vapours by a proper apparatus; and if the liquid which has paſſed over be ſaturated with vegetable alkali, nitre and terra foliata tartari will be obtained; and on ſeparating the latter by means of ſpirit of wine, the vinegar may be had in the ordinary way of decompoſing the ſalt.

1007 From the reſiduum of dulcified ſpirit of nitre.

2. On boiling the reſiduum over again with nitrous acid, the ſame products are obtained; and the more frequently this proceſs is repeated, the leſs acid of ſugar is procured, until at length no veſtige of it is to be met with. 1008

3. Pure acid of ſugar, boiled with 12 or 14 times its quantity of nitrous acid, is entirely decompoſed, and the receiver is found to contain phlogiſticated nitrous acid, vinegar, fixed air, and phlogiſticated air, while a little calcareous earth remains in the retort.

From the decompoſition of acid of ſugar.

1009 From the production of acid of tartar from the reſiduum of dulcified ſpirit of nitre.

4. Acid of ſugar is likewiſe decompoſed by boiling with ſix times its quantity of vitriolic acid. In the receiver we find vinegar phlogiſticated with vitriolic acid, aërial acid; while pure vitriolic acid remains in the retort.

5. By ſaturating the reſiduum of dulcified ſpirit of nitre with chalk, there is formed an inſoluble ſalt, which by treatment with vitriolic acid yields a real acid of tartar, conſtituting a cream of tartar with vegetable alkali. 1010

From the production of empyreumatic acid of tartar from the liquor in which tartarous ſelenite is boiled.

6. On evaporating the liquor from which the tartareous ſelenite was obtained, a dark-coloured matter remains, yielding on diſtillation an empyreumatic acid of tartar, and a ſpongy coal. Hence it would ſeem, that ſpirit of wine conſiſts of acid of tartar, of water, and phlogiſton; ſo that it is a native dulcified acid: and nitrous acid, on being mixed with it in moderate quantity, diſlodges the acid of tartar. On the addition of more nitrous acid, the acid of tartar is reſolved into acid of ſugar and phlogiſton; and by a ſtill greater addition, the ſaccharine acid is changed into vinegar.

1011 From the ſolution of mangane ſe by nitrous acid and acid of ſugar.

7. On boiling one part of the acid of ſugar with one and an half of mangane ſe and a ſufficient quantity of nitrous

Acid of fat. nitrous acid, the manganese will be almost entirely dissolved, and phlogisticated nitrous acid along with vinegar will pass over into the receiver.

8. On boiling together acid of tartar, manganese, and nitrous acid, we obtain a solution of the manganese, with phlogisticated nitrous acid and vinegar as before.

1012 From the solution of the same with vitriolic acid and that of tartar.

9. If acid of tartar be boiled along with vitriolic acid and manganese, the latter will be dissolved, and vinegar with vitriolic acid will pass over into the receiver.

1013 From the digestion of acid of tartar with spirit of wine.

10. On digesting acid of tartar and spirit of wine for several months, the whole is converted into vinegar, the air in the vessel being partly converted into cretaceous acid, and partly into phlogisticated air.

1014 From the solution of manganese with vitriolic acid and spirit of wine.

11. On boiling spirit of wine with vitriolic acid and manganese, it will be converted into vinegar and phlogisticated air.

1015 From the distillation of spirit of wine with caustic alkali.

12. By distilling spirit of wine upwards of 20 times from caustic alkali, it was changed into vinegar, and a considerable quantity of water was obtained.

Hence it appears, says Dr Crell, that the acids of tartar, sugar, and vinegar, are modifications of the same acid, as it contains more or less phlogiston. The acid of tartar has the greatest quantity, the acid of sugar somewhat less, and vinegr the least of all. In these experiments, however, care must be taken that neither the nitrous acid nor fixed alkali employed contain any marine acid, otherwise the results will be uncertain.

## § 18. *Of the Acid of Fat.*

2d 1015 How procured.

This may be obtained from suet by means of many repeated distillations. A small quantity is separated at each distillation; but by distilling the empyreumatic oil into which the suet is thus converted over and over, a fresh quantity is always obtained. The acid of fat in some respects has a resemblance to that of sea-salt; but in others is much more like the vegetable kind, as being destructible in a strong fire, forming compounds which do not deliquesce with calcareous earth, and uniting intimately with oily substances.

3d 1015 Its effects on alkalies, &c.

With alkalies it forms salts entirely different from those yielded by the other acids; with the volatile alkali, particularly, it produces a concrete volatile salt. When saturated with calcareous earth, it yields brown crystals; and a salt of the same kind was obtained by Dr Crell from a mixture of quicklime and suet distilled to dryness, and boiling up the residuum with water. The crystals were hexagonal, and terminated by a plane surface; their taste was acrid and saltish; they did not deliquesce in the air, and were easily and copiously dissolved in water. With magnesia and earth of alum a gummy mass is obtained, which refuses to crystallize.

4th 1015 On metals.

With regard to the metals, Dr Crell informs us, that the acid of fat copiously dissolves manganese into a clear and limpid liquor. It dissolves the precipitate of cobalt, but not the regulus. White arsenic is acted upon but sparingly, and nickel not at all, though it forms a green solution with the precipitate from nitrous acid. Regulus of antimony, by the assistance of heat is dissolved into a clear liquor, which became milky in the cold: it crystallized on evaporation, and did not deliquate in the air. Zinc readily dissolved, and imparted a peculiar metallic taste, falling to the bottom in the form of a white powder on the addition of an alkali. Bismuth in the metallic state was not dissolved; but the precipitate was. It acted upon mercury after being twice distilled from it, and poured afresh upon the metal. The mercury could not be entirely precipitated by common salt. It acted more vigorously upon a precipitate from corrosive sublimate; from the solution of which a white sublimate was obtained after the liquor had been drawn off by distillation. A gold-coloured solution was obtained from platina by distilling the acid from it to dryness, and then pouring it back again; the precipitate of this metal from aqua-regia by spirit of wine was dissolved in great abundance. Iron was very easily dissolved in it, and exhibited a liquor of an astringent taste, which shot into needle-like crystals that did not deliquesce in the air. Lead was corroded and rendered the acid turbid. Minium was converted into a white powder, and then dissolved with greater ease. The solution has a sweet taste, and cannot be precipitated by sea-salt. Tin was corroded into a yellow calx, and dissolved but in very small quantity. Copper was dissolved, even in the cold, into a green liquor; but the solution was greatly promoted by heat. On evaporation it showed some disposition to crystallize, but again attracted moisture from the air. Silver-leaf was attacked only in a very small degree; however, some was precipitated by means of copper, and the marine acid rendered the liquor turbid. The calx precipitated from aquafortis was dissolved more copiously. Silver was precipitated of a white colour from aquafortis by the pure acid itself, as well as by its ammoniacal salt. Half an ounce of the acid distilled four times almost to dryness from some gold-leaves, and at length poured back upon them, the precipitate of a dilute solution of tin obtained by it, gained only a faint colour, rather inclining to red; but a mixture of two parts of acid with one of aquafortis, dissolved gold very readily.

## § 19. *Of Fixed Alkaline Salts.*

Fixed alkaline salts and their combinations.

1016 How procured.

Of these there are two kinds; the vegetable and mineral. The former is never found by itself, and but rarely in combination with any acid; but is always prepared from the ashes of burnt vegetables. It is got in the greatest quantity from crude tartar; from which, if burned with proper care and attention, we may obtain one pound of alkali out of $2\frac{1}{4}$ of the tartar. The latter is found native in some parts of the earth. It is likewise found in very large quantities combined with the marine acid, in the waters of the ocean, and in the bowels of the earth; thus forming the common alimentary salt. It is also produced from the ashes of certain sea-plants, and of the plant called *kali*; from whence both the mineral and vegetable alkalies have taken their name.

1017 Vegetable alkali crystallized.

The vegetable alkali difficultly assumes a crystalline form; nevertheless, it may be partially united with some acids in such a manner as to crystallize, and lose its property of deliquating in the air, without at the same time ceasing to be an alkali. Of this we have an example in the acid of ants abovementioned. Something

thing of the same kind we have observed in treating vegetable fixed alkali with spirit of wine. A gallon of pretty strong spirit of wine being drawn over from a pound of salt of tartar, a black unctuous liquor was left, which shot into crystals very much resembling vitriolated tartar, and which did not deliquate in the air, but were nevertheless strongly alkaline. Dr Black, however, informs us, that the vegetable alkali may be shot into fine crystals; but which cannot be preserved, on account of their great attraction for moisture, unless closely shut up from the air. They have not such a quantity of water as to undergo the aqueous fusion.

The mineral alkali in its natural state always assumes a crystalline form, somewhat resembling that of sal mirabile. It does not deliquate in the air, nor does it seem to have so strong an attraction for water, even when in its most caustic state, as the vegetable alkali: hence mineral alkali is preferable to it in making soap,

1018 which is always of a firmer consistence with mineral than with vegetable alkali. If vegetable alkali is combined with spirit of salt, some change seems to be thereby induced upon it; as the salt produced by expelling the marine acid by means of the vitriolic, and then crystallizing the mass, crystallizes differently from vitriolated tartar. Whether the vegetable alkali might by this means be entirely converted into the mineral, deserves a further inquiry.

Change on the vegetable alkali.

1019 Both mineral and vegetable alkalies, when applied to the tongue, have a very sharp, pungent, and urinous taste; but the vegetable considerably more so than the mineral. They both unite with acids, and form different neutral salts with them: but the vegetable alkali seems to have rather a greater attraction for acids than the other; although this difference is not so great as that a neutral salt, formed by the union of mineral alkali with any acid, can be perfectly decomposed by an addition of the vegetable alkali, unless in considerable excess.

Difference between vegetable and mineral alkalies.

1020 Both vegetable and mineral alkali appear to be composed of an exceedingly caustic salt united with a certain quantity of fixed air. This may be increased so far, as to make the vegetable alkali assume a crystalline form, and lose great part of its alkaline properties: but as the adhesion of great part of this air is very slight, it easily separates by a gentle heat. Some part, however, is obstinately retained; and the alkali cannot be deprived of it by the most violent calcination *per se*. The only method of depriving it entirely of its fixed air is, by mixing an alkaline solution with quicklime.

Composed of a caustic salt and fixed air.

Fixed Alkalies COMBINED,

1021 I. *With Sulphur*. The produce of this is the red fetid compound called *hepar sulphuris*, or liver of sulphur. It may be made by melting sulphur with a gentle heat, and stirring into it, while melted, four times its weight of dry alkaline salt. The whole readily melts and forms a red mass of a very fetid smell, and which deliquates in the air. If sulphur is boiled in a solution of fixed alkaline salt, a like combination will take place.

Hepar sulphuris.

In this process, when the hepar is made either in the dry or the moist way, the fixed air of the alkali is discharged, according to Dr Priestley's observation. Neither does a fixed alkali, when combined with fixed air, seem capable of uniting with sulphur; nor will the union be accomplished without heat, unless the alkali is already in a caustic state. Hence a cold solution of hepar sulphuris may be decompounded, partly at least, by fixed air. On adding an acid, however, the decomposition takes place much more rapidly; and the sulphur is precipitated to the bottom, in form of a white powder. 1022

Decomposed.

During the precipitation of the sulphur from an alkali, by means of acids, a thick white smoke arises, of a most fetid smell and suffocating nature. It burns quietly, without explosion, on a candle's being held in it. Calces of silver, lead, iron, or bismuth, are rendered black by it. Hence, if any thing is wrote with a solution of lead, and a solution of hepar sulphuris is passed over it when dry, the writing, formerly invisible, will immediately appear of a blackish brown colour. Silver, in its metallic state, is prodigiously blackened either by the contact of this vapour, or by being immersed in a solution of the hepar sulphuris itself. Litharge is instantly restored to its metallic state, on being immersed even in a cold solution of hepar sulphuris. 1023

Inflammable vapour in the composition of it.

By being united with an alkali, the acid of sulphur seems very much disposed to quit the phlogiston. If a solution of hepar sulphuris is exposed to the air for some time, it is spontaneously decomposed; the phlogiston of the sulphur flying off, and the acid remaining united with the alkali into a vitriolated tartar. This decomposition takes place so remarkably, when liver of sulphur is dissolved in water, that, by a single evaporation to dryness, it will be almost totally changed into vitriolated tartar. If this substance, in a dry state, be exposed to a moderate degree of heat, and the mass kept constantly stirring, a like decomposition will follow; the phlogiston of the sulphur will fly off, and the acid unite with the alkali. 1024

Phlogiston of sulphur disposed to quit the acid.

Liver of sulphur is a great solvent of metallic matters; all of which, except zinc, it attacks, particularly in fusion. It seems to dissolve gold more effectually than other metals. This compound also dissolves vegetable coals, even by the humid way: and these solutions, if suffered to stand in the open air, always precipitate a black powder, no other than the coal they had dissolved, in proportion to the quantity of hepar sulphuris decomposed. When vegetable coal is thus dissolved by liver of sulphur in fusion, it is of a much deeper red than in its natural state. The solution in water is of a green colour. 1025

Metals and charcoal dissolved by it.

II. *With Expressed Oils*. The result of this combination is *soap*; for the preparation of which in large quantities in the way of trade, see SOAP. The soap which is used in medicine is prepared without heat, in the following manner, according to the author of the Chemical Dictionary. 1026

Soap.

"One part of quicklime, and two parts of good Spanish soda (the salt prepared from the ashes of the herb kali), are boiled together during a short time in an iron caldron. This lixivium is to be filtered, and evaporated by heat, till a phial, capable of containing an ounce of water, shall contain an ounce and 216 grains of this lixivium. One part of this lixivium is to be mixed with two parts of oil of olives, or of sweet almonds, in a glass or stone-ware vessel. The mixture soon becomes thick and white; and must be stirred from time to time with an iron spatula. The combination

Fixed alkaline salts and their combinations. nation is gradually completed, and in seven or eight days a very white and firm soap is obtained."

In attempting combinations of this kind, it is absolutely necessary that the alkali be deprived of its fixed air as much as possible; otherwise the soap will be quite unctuous and soft: for fixed alkalies have a greater attraction for fixed air than for oil, and hence soap is decompounded by blowing fixed air into a solution of it in water. It may be made either with tallow, wax, spermaceti, butter of cocoa, the coarser resinous substances, or animal oils.

1027 Starkey's soap. III. *With Essential Oils.* The volatility of these oils in a great measure hinders them from being acted upon by alkalies: nevertheless, combinations of this kind have been attempted; and the compounds so produced have been called *Starkey's soap*, from one Starkey a chemist, who endeavoured to volatilize salt of tartar by combining it with oil of turpentine. His method was to put dry salt of tartar into a matrass, and pour upon it essential oil of turpentine to the height of two or three fingers breadth. In five or six months, a part of the alkali and oil were combined into a white saponaceous compound. This must be separated from the mixture, and more of it will afterwards be formed by the same method.

Chemists, imagining this soap to be possessed of considerable medical virtues, have endeavoured by various methods to shorten this tedious process. Of these one of the most expeditious is that recommended by Mr Beaumé; which consists in triturating, for a long time, alkaline salt upon a porphyry, and adding oil of turpentine during the trituration. According to him, the thick resinous part of the oil only can combine with the salt; and, during the time this combination is effected, the more subtile and attenuated parts will fly off. Hence he finds that the opeartion is considerably abridged by the addition of a little turpentine or common soap. The most expeditious of all, however, is that mentioned by Dr Lewis; which consists in heating the alkali red hot, and then throwing it into oil of turpentine, stirring them well together; on which they immediately unite into a saponaceous mass.

This kind of soap is subject to great alterations from keeping; particularly the loss of its colour, and a kind of decomposition occasioned by the extraction of an acid from the oil of turpentine, which unites with the alkali, and crystallizes not only all over the surface, but in the very substance of the soap. The nature of this salt is unknown, but certainly deserves consideration.

1028 Phlogisticated alkalies. IV. *With Phlogiston.* This combination is effected by calcining them with the charcoal either of vegetable or animal matters. The consequence is, that they are greatly altered in their properties; sometimes so much as to be enabled to precipitate calcareous earths from their solutions in acids. Metallic solutions precipitated by them in this state, assume different colours.

Differences observed between Fixed Alkalies obtained from different *Vegetables.*

These differences we must conceive to arise from some proportion of the oily and phlogistic matter of the vegetable remaining in the ashes from whence the salts are extracted; for when reduced to their utmost purity, by repeated calcinations in a strong fire, and deliquations in the air, all of them, the marine alkali excepted, appear to be the very same.

On this subject Mr Gmelin has given a great number of experiments in the fifth volume of the *Commentaria Petropolitana*; and found very considerable differences, not only between the alkaline salts, but likewise the pure vegetable earths obtained from different vegetables by burning. The salts of the several plants examined were prepared with great care, and all of them exactly in the same manner; each vegetable being burnt in a separate crucible, with the same degree of fire, till no remains of coaly matter could any longer be perceived; and the ashes elixated in glass vessels with cold distilled water. The salts, thus obtained, were found to produce different colours on mixture with certain liquors, and to effervesce in very different degrees with acids: certain metallic solutions were by some precipitated, by others only rendered thicker, by others both precipitated and rendered thick; whilst some occasioned neither the one nor the other of these changes, but left the fluid clear and transparent. Thus, with the vitriolic acid, the salts of southernwood and sage struck a pale brown colour; those of pine-tops and rue, a yellow; that of fern, a reddish yellow; and that of sanicle, a dark leek-green: that of dill yielded a leek-green precipitate, with elegant green flakes floating in the liquor. This last salt also gave a greenish precipitate with the marine acid, and a red one with the nitrous. Solution of corrosive sublimate was changed yellow by salt of southernwood; of a brownish colour, by that of colt's-foot; of a deep red, by that of wormwood; and of a pitch-colour, by that of dill. That of fern threw down an opal-colour; of sage, a sulphur-yellow; of elder flowers, a citron yellow; of sanicle, a saffron colour; and of milfoil, a deep-red precipitate. From solution of silver, salt of *carduus benedictus* threw down a white; of camomile, a grey; of hyssop, a brownish; of dill, a blackish brown; of scabious, a yellowish; and that of pine-tree tops, a sulphur yellow precipitate. Solution of vitriol of copper was changed by salt of southernwood to a bright sea-green; by that of dill, to an unsightly green; of agrimony, to a greenish blue; and by that of milfoil, to a bright sky-blue: the salt of penny-royal made the liquor thick as well as blue, and that of feverfew made it thick and green: the salt of hyssop threw down a green precipitate, that of scurvy-grass a blue one, and that of fumitory a greenish blue: whilst the salt of fern made scarcely any change either in the colour or consistency of the liquor.

1029 Mr Gmelin's experiments.

## § 19. *Of Volatile Alkali.*

1030 Whence obtained. This is a kind of salt obtained from all animal, some vegetable, substances, from soot by distillation with a strong heat, and from all vegetable substances by putrefaction. Though a volatile alkali is procurable from all putrid animal substances by distillation, yet the putrefactive process does not seem to prepare volatile alkali in all of these. Putrid urine, indeed, contains a great quantity of alkali ready formed, whence its use in scouring, *&c.* but the case is not so with putrid blood or flesh. These afford no alkali till after the phlegm has arisen; and this they would

Volatile alkali and its combinations.

would do, though they had not been putrefied. According to Mr Wiegleb, volatile alkali is found in limestone, lapis suillus, chalk, marble, coals, turf, loam, clay, and many other kinds of earth. Its existence in these substances may be discovered merely by distilling them with a brisk fire, but still better by the addition of some quantity of fixed alkali or quicklime before the distillation.—It has even been found in all mineral salts and their acids, as vitriol, nitre, common salt, and the acid liquors drawn from these substances, also in gypsum and sulphur: from all which it may be separated by means of quicklime.—In the vegetable kingdom it is produced by dry distillation from mustard-seed, elder flowers and leaves; the leaves of the wild cherry-tree, white water-lilies, tobacco, and sage; as well as from many other plants. According to our author, the plainest proof of its existing almost universally in the vegetable kingdom, is, that the soot of our chimneys affords a volatile alkali by distillation, either with or without quicklime.

Volatile alkali, when pure, appears of a snowy whiteness; has a very pungent smell, without any disagreeable empyreuma; is very easily evaporable, without leaving any residuum; effervesces with acids much more strongly than fixed alkali; and forms with them neutral compounds called *ammoniacal salts*, which we have already described, and which are different according to the nature of the acid made use of; for all volatile alkalies, when perfectly purified, appear to be the very same, without the smallest difference.

Like fixed alkalies, these salts contain a great quantity of fixed air, on which their solidity depends; and which may be so increased as perfectly to neutralize, and deprive them of their peculiar taste and smell. When neutralized by fixed air, they have a very agreeable pungent taste, somewhat resembling that of weak fermenting liquors. When totally deprived of fixed air, by means of lime, they cannot be reduced to a solid form; but are dissipated in an invisible and exceedingly pungent vapour, called by Dr Priestley *alkaline air*. When volatile alkaline salt is dissolved in water, the solution is called *volatile alkaline spirit*.

## Distillation and Purification of *Volatile Alkalies*.

1031 Distilling vessel, and method of performing the operation.

The materials most commonly used for preparing volatile alkalies are the solid parts of animals, as bones, horns, *&c.* These are to be put into an iron pot of the shape recommended for solution; to this must be fitted a flat head, having a hole in the middle about two inches diameter. From this a tube of plate-iron must issue, which is to be bent in such a manner that the extremity of it may enter an oily jar, through an hole made in its upper part, and dip about half an inch under some water placed in the lower part. The mouth of the jar is to be fitted with a cover, luted on very exactly; and having a small hole, which may be occasionally stopped with a wooden peg. The junctures are to be all luted as close as possible, with a mixture of clay, sand, and some oil; and those which are not exposed to a burning heat, may be further secured by quicklime and the white of an egg, or by means of glue. A fire being now kindled, the air contained in the distilling vessel is first expelled, which is known by the bubbling of the water; and to this vent must be given by pulling out the wooden peg. A considerable quantity of phlegm will then come over, along with some volatile alkali, a great quantity of fixable air, and some oil. The alkali will unite with the water, and likewise some part of the fixed air, the oil swimming above. A great many incoercible vapours, however, will come over, to which vent must be given from time to time, by pulling out the peg. The distillation is to be continued till all is come over; which may be known by the cessation, or very slow bubbling of the water. The iron pipe must then be separated from the cover of the distilling vessel, lest the liquid in the jar should return into it, on the air being condensed by its cooling. In the jar will be a volatile spirit, more or less strong according as there was less or more water put in, with an exceedingly fetid black oil floating upon it.

1032 Rectification.

The rectification of the volatile alkali is most commodiously performed at once by combining it with an acid; and, as spirit of salt has the least affinity with inflammable matter, it is to be chosen for this purpose, in preference to the vitriolic or nitrous. As the spirit is excessively oily, though already much weakened by the admixture of the water in the jar, if a very large quantity was not originally put in, an equal quantity of water may still be added, on drawing off the spirit. That as little may be lost as possible, the spirit should be received in a stone bottle; and the marine acid, likewise in a distilled state, added by little and little, till the effervescence ceases. The liquor, which is now an impure solution of sal ammoniac, is to be left for some time, that the oil may separate itself; it is then to be filtered, evaporated, and crystallized in a leaden vessel. If the crystals are not sufficiently pure at the first, they will easily become so on a second dissolution.

1033 Volatile sal ammoniac.

From sal ammoniac thus obtained pure, the volatile alkali may be extricated by distillation with chalk, alkaline salts, or quicklime. Alkaline salts act more briskly than chalk, and give a much stronger volatile alkali. The strength of this, however, we know may be altered at pleasure, by adding to, or depriving it of, its natural quantity of fixed air. Hence, perhaps, the best method would be, to prepare volatile alkalies altogether in a fluid state, by means of quicklime; and then add fixed air to them, by means of an apparatus similar to that directed by Dr Priestley for impregnating water with fixed air. To prevent lime from adhering to the distilling vessels in which it is put, the translator of Wiegleb's chemistry recommends the putting in three or four ounces of common salt along with the other ingredients.

## Volatile alkalies COMBINED,

1034 Cuprum ammoniacale.

I. *With Metals.* There are only three metals, *viz.* copper, iron, and lead, upon which, while in their metallic form, volatile alkalies are capable of acting. Copper-filings are dissolved by volatile alkali, especially in its caustic state, into a liquor of a most admirable blue colour. It is remarkable, that this colour depends entirely upon the air having access to the solution: for if the bottle containing it is close stopt, the liquor becomes colourless; but, however, resumes its blue colour on being exposed to the air. On evaporation, a blue saline mass is obtained, which, mixed with fats, or other inflammable matters, tinges their flame green, leaving a red calx of copper, soluble again in volatile spirits as at first. This saline sub-

stance

Volatile alkali and its combinations.

ſtance has beed received into the laſt edition of the Edinburgh Diſpenſatory, under the name of *cuprum ammoniacale*, as an antiepileptic.

1035 Copper, fulminating.

The blue mixture of ſolution of copper in aquafortis with volatile ſpirits, yields ſapphire-coloured cryſtals, which diſſolve in ſpirit of wine, and impart their colour to it. If, inſtead of cryſtallization, the liquor be totally evaporated, the remaining dry matter explodes, in a moderate heat, like aurum fulminans. This is given as a fact by Dr Lewis; but hath not ſucceeded upon trial by Dr Black. Various phenomena, ſays Mr Wiegleb, occur in the diſſolution of copper by the volatile alkali.—On ſaturating dilute ſpirit of ſal ammoniac with copper-filings, cryſtals are formed of a dark-blue colour, but which, by expoſure to the air, fall to pieces and become green. Vinous ſpirit of ſal ammoniac impregnated with copper, loſes in an inſtant its blue colour, on the affuſion of an equal quantity of ſaturated ſolution of fixed alkaline ſalt. The copper is then taken up by the fixed alkaline ſolution, which of conſequence acquires a blue colour, while the ſpirit of wine, deprived of the metal, floats clear on the top. When filings of copper are put into a bottle, and that bottle quite filled with cauſtic volatile alkali, and is immediately ſtopped up, no ſolution takes place: but when the bottle is left open, only for a ſhort time, or an empty ſpace is left in it, a colourleſs ſolution is obtained, which in the air obtains a blue colour; but which may be deprived of this colour as often as we pleaſe, by ſhutting it up exactly from the air, and letting it ſtand, in this ſituation, on freſh filings of copper.—From theſe phenomena Mr Wiegleb concludes, that copper does not diſſolve in volatile alkali until it has loſt part of its phlogiſton, to which the air, by the attraction it exerts upon it, contributes its ſhare. If this has taken place only in a ſmall proportion, and the farther acceſs of air be prevented, the remainder will be diſſolved without any colour; which, however, appears in the inſtant that, by a freſh acceſſion of air, the phlogiſton ſtill remaining finds means to eſcape. The diſſolved copper is always precipitated when the ſolution meets with phlogiſticated copper. The colourleſs ſolution is precipitated by zinc and vitriolic acid, but not by iron. It taſtes rather ſweet, and does not ſmell very ſtrong of volatile alkali; while, on the contrary, the blue ſolution has a pungent ſmell, and is precipitated by diſtilled water.

On the other two metals the action of volatile alkali is by no means ſo evident; it diſſolves iron very ſlowly into a liquor, the nature of which is not known; and lead is corroded by it into a mucilaginous ſubſtance.

II. *With Inflammable Subſtances.* With expreſſed oils, the cauſtic volatile alkali unites into a ſoft unctuous maſs, of a very white colour, imperfectly ſoluble in water, and which is ſoon decompoſed ſpontaneouſly.

1036 Sal volatile oleoſum.

Compoſitions of this kind are frequently uſed for removing pains, and ſometimes with ſucceſs. With eſſential oils, volatile alkalies may be united, either in their dry or liquid form, by means of diſtillation. The produce is called *ſal volatile oleoſum;* it is much more frequently uſed in a liquid than in a dry form. The general method of preparation is by diſtilling volatile alkali along with eſſential oils and ſpirit of wine, or the aromatic ſubſtance from whence the eſſential oils are drawn. Theſe compoſitions are variable at pleaſure; but certain forms are laid down in the diſpenſatories, with which it is expected that all the chemiſts ſhould comply in the preparation of theſe medicines.

1037 Spiritus volatilis ſuccinatus.

III. *Eau de Luce.* This is the name given to an exceedingly volatile ſpirit, which ſome years ago was pretty much in vogue; and indeed ſeems very well calculated to anſwer all the purpoſes for which volatile alkalies can be uſed. It was of a thick white colour, and ſmelled ſomewhat of oil of amber. A receipt appeared in Lewis's Diſpenſatory for the preparation of this fluid, under the name of *ſpiritus volatilis ſuccinatus.* The method there directed, however, did not ſucceed; becauſe, though the alkaline ſpirit is capable of keeping a ſmall quantity of oil of amber ſuſpended, the colour is greatly more dilute than that of genuine eau de luce. In the Chemical Dictionary we have the following receipt: "Take four ounces of rectified ſpirit of wine, and in it diſſolve 10 or 12 grains of white ſoap; filter this ſolution; then diſſolve in it a drachm of rectified oil of amber, and filter again. Mix as much of this ſolution with the ſtrongeſt volatile ſpirit of ſal ammoniac, as will be ſufficient, when thoroughly ſhaken to give it a beautiful milky appearance. If upon its ſurface be formed a cream, ſome more of the oily ſpirit muſt be added."

This receipt likewiſe ſeems inſufficient. For the oil of amber does not diſſolve in ſpirit of wine: neither is it probable that the ſmall quantity of ſoap made uſe of could be of any ſervice; for the ſoap would diſſolve perfectly in the alkaline ſpirit, without ſuffering any decompoſition. The only method which we have found to anſwer is the following. Take an ounce, or any quantity at pleaſure, of balſamum Canadenſe; place it in a ſmall china baſon, in a pan of boiling water, and keep it there till a drop of it taken out appears of a reſinous conſiſtence when cold. Extract a tincture from this reſin with good ſpirit of wine; and having impregnated your volatile ſpirit with oil of amber, lavender or any other eſſential oil, drop in as much of the ſpiritous tincture as will give it the deſired colour. If the volatile ſpirit is very ſtrong, the eau de luce will be thick and white, like the cream of new milk; nor is it ſubject to turn brown with keeping

1038 Volatile alkali combined with ſulphur.

IV. *With Volatile Tincture of Sulphur.* This is a combination of the cauſtic volatile alkali, or ſpirit of ſal ammoniac, with ſulphur. It is uſually directed to be made by grinding lime with the ſulphur and afterwards with the ſal ammoniac, and diſtilling the whole in a retort, but the produce is by this method very ſmall, and even the ſucceſs uncertain. A preferable method ſeems to be, to impregnate the ſtrongeſt cauſtic volatile ſpirit with the vapour which ariſes in the decompoſitions of hepar ſulphuris by means of an acid, in the ſame manner as directed for impregnating water with fixed air.

1039 Sympathetic ink.

This preparation has a moſt nauſeous fetid ſmell, which ſpreads to a conſiderable diſtance; and the effluvia will blacken ſilver or copper, if barely placed in the neighbourhood of the unſtopped bottle. This property renders it capable of forming a curious kind of ſympathetic ink; for if paper is wrote upon with a ſolution of ſaccharum ſaturni, the writing, which diſappears when dry, will appear legible and of a

brownish

Phenomena from mixtures of acid, &c. salts.

brownish black, by barely holding it near the mouth of the bottle containing volatile tincture of sulphur. The vapours of this tincture are so exceedingly penetrating, that it is said they will even penetrate through a wall, so as to make a writing with saccharum saturni appear legible on the other side; but this is much to be doubted. It is even said that it cannot penetrate through the substance of paper, but only insinuates itself betwixt the leaves; and hence if the edges of the leaves are glued together no black colour will appear.

§ 20. *Of the* PHENOMENA *resulting from different mixtures of the Acid, Neutral, and Alkaline* SALTS, *already treated of.*

1040 Of mixing the acid spirits with one another.

1. IF concentrated oil of vitriol is mixed with strong spirit of nitre, or spirit of salt, the weaker acid will become exceedingly volatile, and emit very elastic fumes; so that if a mixture of this kind is put into a close stopt bottle, it will almost certainly burst it. The same effect follows upon mixing spirit of salt and spirit of nitre together. In this case, both acids become surprisingly volatile; and much of the liquor will be dissipated in fumes, if the mixture is suffered to stand for any considerable time. Such mixtures ought therefore to be made only at the time they are to be used.

1041 Dissolving vitriolic salts in nitrous or marine acids.

2. If vitriolated tartar is dissolved in an equal quantity of strong spirit of nitre, by heating them together in a matrass, the stronger vitriolic acid will be displaced by the weaker nitrous one, and the liquor, on cooling, will shoot into crystals of nitre. The same thing happens also upon dissolving vitriolated tartar, or Glauber's salt, in spirit of salt. This observation we owe to Monf. Beaumé, and the reason of it has been already explained. See n° 285.

1042 Decomposition of vitriolic salts by solutions of earth, &c. in nitrous or marine acids.

3. If vitriolated tartar, or Glauber's salt, is dissolved in water, and this solution mixed with another consisting of calcareous earth, silver, mercury, lead, or tin, dissolved in the nitrous or marine acids, the vitriolic acid will leave the fixed alkali with which it was combined, and, uniting with the calcareous earth or metal, fall with it to the bottom of the vessel. This decomposition takes place only when the vitriolic acid meets with such bodies as it cannot easily dissolve into a liquid, such as those we have just now mentioned; for though vitriolated tartar is mixed with a solution of iron, copper, &c. in the nitrous or marine acids, no decomposition takes place. The case is not altered, whatever acid is made use of; for the marine acid will effectually separate silver, mercury, or lead, from the vitriolic or nitrous acids.

1043 By lime-water.

4. According to Dr Lewis, if a solution of vitriolated tartar is dropt into lime-water, the acid will unite with the lime, and precipitate with it in an indissoluble selenite, the alkali remaining in the water in a pure and caustic state.

1044 Of green vitriol by saccharum saturni.

5. If green vitriol is mixed with any solution containing substances which cannot be dissolved into a liquid by the vitriolic acid, the vitriol will be immediately decomposed, and the liquor will become a solution of iron only. Thus, if green vitriol is mixed with a solution of saccharum saturni, the vitriolic acid immediately quits the iron for the lead, and falls to the bottom with the latter, leaving the vegetable acid of the saccharum saturni to combine with the iron.

1045 Of solution of tin by saccharum saturni.

6. If solution of tin in aqua-regia is mixed with solution of saccharum saturni, the marine acid quits the tin for the lead contained in the saccharum; at the same time, the acetous acid, which was combined with the lead, is unable to dissolve the tin which was before kept suspend by the marine acid. Hence, both the saccharum saturni, and solution of tin, are very effectually decomposed, and the mixture becomes entirely useless. Dyers and callico-printers ought to attend to this, who are very apt to mix these two solutions together; and no doubt many of the faults of colours dyed or printed in particular places, arise from injudicious mixtures of a similar kind. See DYEING.

1046 Of calcareous solutions by mild volatile alkali.

7. If mild volatile alkali, that is, such as remains in a concrete form, by being united with a large quantity of fixed air, is poured into a solution of chalk in the nitrous or marine acids, the earth will be precipitated, and a true sal ammoniac formed. If the whole is evaporated to dryness, and a considerable heat applied, the acid will again part with the alkali, and combine with the chalk. Thus, in the purification of volatile alkalies by means of spirit of salt, the same quantity of acid may be made to serve a number of times. This will not hold in volatile spirits prepared with quicklime.

1047 Sal alembroth.

8. If equal parts of sal ammoniac and corrosive sublimate mercury are mixed together and sublimed, they unite in such a manner as never to be separable from one another without decomposition. The compound is called *sal alembroth*; which is said to be a very powerful solvent of metallic substances, gold itself not excepted. Its powers in this, or any other respect, are at present but little known. By repeated sublimations, it is said this salt becomes entirely fluid, and refuses to arise in the strongest heat.

1048 Solution of salts promoted by vitriolic acid.

9. If vitriolic acid is poured upon any salt difficult of solution in water, it becomes then very easily soluble. By this means, vitriolated tartar, or cream of tartar, may be dissolved in a very small quantity of water.

SECT. II. *Earths.*

THE general divisions and characters of these substances we have already given; and most of their combinations with saline substances have been mentioned, excepting only those of the terra ponderosa; a substance whose properties have been but lately inquired into, and are not yet sufficiently investigated. In this section, therefore we have to take notice only of their various combinations with one another, with inflammable, or metallic substances, &c. As they do not, however, act upon one another till subjected to a vitrifying heat, the changes then induced upon them come more properly to be treated of under the article GLASS. Upon metallic and inflammable substances (sulphur alone excepted), they have very little effect; and therefore what relates to these combinations shall be taken notice of in the following sections. We shall here confine ourselves to some remarkable alterations in the nature of particular earths by combination with certain substances, and to the phosphoric quality of others.



§ 1.

**Terra ponderoſa and its combinations.**

### § 1. *The* Terra Ponderosa.

This earth is of the true calcareous kind, and capable of being converted into a very acrid lime; but in other reſpects is very different. It is moſt commonly met

1049 **Uſually found united with the vitriolic acid.** with in the veins of rocks, united with the vitriolic acid in a maſs ſomewhat reſembling gypſum, but much heavier and more opaque; and from the great weight of this ſubſtance the earth itſelf has its name, though when freed from the acid it is by no means remarkable for this property. Its properties were firſt taken notice of by the foreign chemiſts; but they have been more accurately inveſtigated by Dr Withering, who has

1050 **Dr Withering's experiment.** publiſhed his obſervations in the 74th volume of the Philoſophical Tranſactions. His experiments were not made on the gypſeous ſubſtance abovementioned; but on a combination of the earth with fixed air, which is much more uncommon, and like the other poſſeſſes a very conſiderable degree of ſpecific gravity. Both theſe combinations have the general name of *ſpathum ponderoſum*, or *ponderous ſpar;* the former being alſo called *baroſelenite*, &c.

1051 **Combination of terra ponderoſa with aërial acid deſcribed.** The ſpar uſed by Dr Withering was got out of a lead mine at Alſton moor in Cumberland. Its appearance was not unlike that of a lump of alum; but on cloſer inſpection it appeared to be compoſed of ſlender ſpiculæ in cloſe contact, more or leſs diverging, and ſo ſoft that it might be cut by a knife; its ſpecific gravity from 4.300 to 4.338. It effervesced with acids, and

1052 **Effects of fire upon it.** melted, though not very readily, under the blow-pipe. In a common fire it loſt its tranſparency; and on being urged with a ſtronger heat in a melting furnace, it adhered to the crucible, and ſhowed ſigns of fuſion; but did not appear to have loſt any of its fixed air, either by diminution in weight, becoming cauſtic, or loſing its power of effervеſcing with acids.

1053 **Treated with marine acid.** Five hundred grains of this ſpar, by ſolution in muriatic acid, loſt 104 grains in weight, and left an inſoluble reſiduum of three grains. In another experiment, 100 grains of ſpar loſt 21; and there remained only 0.6 of a grain of inſoluble matter.

On diſſolving another hundred grains in dilute muriatic acid, 25 ounce-meaſures of air were obtained, which by proper trials appeared to be pure aërial acid; and, on precipitating the ſolution with mineral alki, 100 grains of earth were again obtained; but on diſſolving the precipitate in freſh muriatic acid, only 20 ounce-meaſures of air were produced.

1054 **Precipitated by mild and cauſtic fixed alkalies.** Mild vegetable alkali precipitated a ſaturated ſolution of this ſpar in marine acid, with the eſcape of a quantity of fixed air; and the ſame effect took place on the addition of foſſil alkali; but with cauſtic alkalies there was no appearance of effervеſcence, though a precipitate likewiſe fell.

Fifty parts of ſpar, diſſolved in marine acid, loſt 10½; and with cauſtic vegetable alkali, a precipitate weighing 45½ was obtained. Phlogiſticated alkali precipitated the whole of the earth, as appeared by the addition of mild fixed alkali afterwards, which oc-

1055 **Convertible into lime capable of decompoſing vitriolic ſalts.** caſioned no farther precipitation.

Part of the precipitate thrown down by the mild alkali was expoſed to a ſtrong heat in a crucible, and then put into water. The liquid was inſtantly converted into a very acrid lime-water, which had the following remarkable properties: The ſmalleſt portion of vitriolic acid, added to this water, occaſioned an immediate and copious precipitation, which appeared even after the liquid was diluted with 200 times its bulk of pure water. 2. A ſingle drop let fall into a ſolution of Glauber's ſalt, vitriolated tartar, alum, vitriolic ammoniac, Epſom ſalt, or ſelenite, occaſioned an immediate and copious precipitate in all of them: the reaſon of which was the ſuperior attraction of the ponderous earth for the acid of theſe ſalts, which forming with it an indiſſoluble concrete, inſtantly fell to the bottom.

1056 **Inſoluble precipitate thrown down by cauſtic alkali.** The precipitate thrown down by the cauſtic vegetable alkali was put into water, but exhibited no ſuch appearances as the other: even the mixture was boiled; nor had it any acrimonious taſte. On adding the three mineral acids to ſeparate portions of the precipitate itſelf, neither effervеſcence, nor any ſign of ſolution, appeared. After ſtanding an hour, water was added, and the acids were ſuffered to remain another hour on the powder; but on decanting them afterwards, and adding foſſile alkali to the point of ſaturation, no precipitate appeared.

The precipitate thrown down by the phlogiſticated alkali, mixed with nitre and borax, and melted with a blow-pipe on charcoal, formed a black glaſs; on flint-glaſs, a white one; and on a tobacco-pipe, a yellowiſh white one. Another portion, melted with ſoap and borax in a crucible, formed a black glaſs.

The ſmall quantity of inſoluble reſiduum formerly mentioned, appeared to be the combination of ponderous earth with vitriolic acid, called *heavy* gypſum, marmor metallicum, baroſelenite, *&c.*

1057 **Analyſis and properties of aërated ponderous ſpar.** From theſe experiments the Doctor concludes, that 100 parts of this ſpar contain 78.6 of pure ponderous earth, $\frac{6}{10}$ of a grain of marmor metallicum, and 20.8 grains of fixed air. 2. The quantity of mild alkali neceſſary to ſaturate any given portion of acid, contains a greater quantity of fixed air than can be abſorbed by that quantity of terra ponderoſa which the acid is able to diſſolve. 3. The terra ponderoſa, when precipitated by means of a mild alkali, readily burns to lime; and this lime-water proves a very nice teſt of the preſence of vitriolic acid. 4. In its native ſtate the terra ponderoſa will not burn to lime; when urged with a ſtrong fire, it melts and unites with the crucible, without becoming cauſtic; nor can it be made to part with its fixed air by any addition of phlogiſton. He conjectures, therefore, that as cauſtic lime cannot unite to fixed air without moiſture, and as this ſpar ſeems to contain no water in its compoſition, it is the want of water which prevents the fixed air aſſuming its elaſtic aerial ſtate. "This ſuppoſition (ſays he) becomes ſtill more probable, if we obſerve, that when the ſolution of the ſpar in an acid is precipitated by a mild alkali, ſome water enters into the compoſition of the precipitate; for it has the ſame weight as before it was diſſolved, and yet produces only 20 ounce-meaſures of fixed air, while the native ſpar contains 25 of the ſame meaſures: ſo that there is an addition of weight equal to five ounce-meaſures of air, or three one-half grains, to be accounted for; and this can only ariſe from the water. 5. The precipitate formed by the cauſtic alkali, taking ſome of the latter down with it, forms a ſubſtance neither ſoluble in acids nor water. This inſoluble compound is alſo formed by adding the lime-water already

*Terra ponderosa and its combinations.*

ready mentioned, to a solution of caustic vegetable, or fossile fixed alkali, but not with volatile alkali. 6. Fixed vegetable as well as mineral alkali, and even volatile alkalies, whether mild or caustic, are capable of separating terra ponderosa from any other acid excepting the vitriolic; but from it neither mild nor caustic alkalies are capable of separating this earth,

1058 **Terra ponderosa a test of the presence of vitriolic acid.**

excepting the vegetable fixed alkali, which will partly do it by an intense heat in the dry way. 7. This earth affords an excellent method of purifying the nitrous and marine acids from any portion of the vitriolic; for the attraction between terra ponderosa and this acid is so strong, that the least portion of the latter will be instantly detected by the lime-water above

1059 **White matter contained in vitriolic acid found to be gypsum.**

mentioned. The vitriolic acid, Dr Withering observes, is commonly adulterated with a white powder, which discovers itself by turning the liquor milky when the acid is diluted with water; and this powder he finds to be gypsum, from the following properties:

1. By repeated boiling in water, six grains and a half were reduced to two. 2. By gentle evaporation this solution afforded five grains of crystals as hard and tasteless as selenite. 3. A precipitate was formed by mild fossile alka on adding it to a solution of these crystals in water. 4. On exposing this powder to a pretty strong heat, and then putting it into water, the latter became acrid, and acquired the taste of lime-water. 5. The insoluble part suffered no change by boiling in nitrous acid: one half of it mixed with borax, and exposed to the blow-pipe upon charcoal, melted into glass; the other half, mixed with borax, and exposed to the blow-pipe upon charcoal, did the same; whence it appears, says our author, that the greatest part of this substance was calx vitriolate or selenite; the remainder a vitrifiable earth. He had before found, that the heavy gypsum, or marmor metallicum, would dissolve in concentrated vitriolic acid, but always separated upon the addition of water; and from his experiments it now appears that selenite does the same.

1060 **Experiments on the marmor metallicum.**

Dr Withering next proceeds to give a set of experiments on the heavy gypsum, marmor metallicum of Cronstadt, or the Baroselenite of others, already mentioned. The specimens he obtained were from Kilpatrick hills near Glasgow, and a sort with smaller crystals found among the iron ore about Ketley in Shropshire, and in the lead-mines at Alston-Moor. He describes it as white, nearly transparent, but without the property of double refraction; composed of laminæ of rhomboidal crystals, and decrepitating in

1061 **Description of a kind found near Edinburgh.**

the fire; the specific gravity from 4.402 to 4.440. The specimens we have seen differ considerably from this description, being composed, to appearance, of thin laminæ; which all together form a very opaque white mass, which has not the least transparency unless split excessively thin. They are found about three miles to the southwest of Edinburgh, near Pentland hills, and likewise betwixt Edinburgh and Leith. In the former place they lie in small veins of a rock consisting of a kind of iron stone, and so closely adhering to it, that it would seem either that the stone is converted into the spathum ponderosum, or the latter into the stone. It is therefore often intermixed with the rock so intimately, that it is impossible to separate them perfectly from each other.

Dr Withering having exposed 100 grains of the marmor metallicum to a red heat for an hour, in a black crucible, found that it had lost five grains of its

1062 **Effects of heat upon it.**

weight; but as a sulphureous smell was perceptible, he suspected that a decomposition had taken place, and therefore exposed another portion to a similar heat in a tobacco-pipe, which had no smell of sulphur, nor was it diminished in weight. It melted with borax into a white opaque glass, but was barely fusible by

1063 **May be dissolved in very concentrated vitriolic acid.**

itself under the blow pipe. It did not seem to dissolve in water, nor in any of the acids, except the vitriolic, when by long boiling it had become very concentrated and almost red hot. It then appeared perfectly dissolved; but separated again unchanged on the addition of water. On exposing the vitriolic solution to the atmosphere for some days, beautiful radiated crystals were formed in it.

1064 **Precipitated from it unchanged by vegetable fixed alkali.**

On adding a solution of mild vegetable alkali to this vitriolic solution, a precipitate appeared; but it consisted of marmor metallicum unchanged. An ounce of it in fine powder was then fused with two of salt of tartar until it ran thin, when six drachms of a residuum insoluble in water were left. On the addition of

1065 **May be decomposed in the dry way by salt of tartar.**

nitrous acid, only 52 grains were left, which appeared to be marmor metallicum unchanged. On saturating the alkaline solution with distilled vinegar, and washing the precipitate, the liquor was found to contain terra foliata tartar, formed by the union of the acetous acid with part of the alkali; and of vitriolated tartar, formed by that of the alkali with the native acid of the marmor metallicum.

1066 **Nitrous solution shoots into fine crystals.**

The salt formed by the nitrous acid shot readily into beautiful permanent crystals of a rough bitterish taste. Some of the salt deflagrated with nitre and charcoal, left by washing the terra ponderosa very white, capable of being burnt into lime, and again forming an insoluble compound with vitriolic acid. An hundred grains of aerated terra ponderosa, dissolved in marine acid, and precipitated by the vitriolic, were augmented 17 grains in weight. Hence it appears,

1067 **Analysis and properties of the marmor metallicum.**

1. That the marmor metallicum is composed of vitriolic acid and terra ponderosa. 2. That this compound has very little solubility in water. 3. That it can only be dissolved in highly concentrated oil of vitriol, from which it separates unchanged on the addition of water. 4. That it cannot be decomposed in the moist way, by mild fixed alkali, though it may be so in the dry. 5. That it may be decomposed by the union of inflammable matter to its acid, by which sulphur is formed, though the acid cannot be dissipated by mere heat. 6. An hundred parts of this substance contain 32.8 of pure vitriolic acid, and 57.2 of terra ponderosa. The marmor metallicum, our author remarks, may possibly be useful in some cases where a powerful flux is wanted; for having mixed some of it with the black flux, and given the mixture a strong heat in a crucible, it ran entirely through the pores of the vessel.

1068 **Cauk, a substance of this kind, found in Derbyshire in England.**

Dr Withering describes two other kinds of this substance, known by the name of *cauk*, and found in the mines of Derbyshire, and other places. These differ from the other only in containing a small proportion of iron. On the whole, he concludes, that "the terra ponderosa seems to lay claim to a middle place betwixt the earths and metallic calces. Like the former-

Transmutation of flints into an earth soluble in acids.

mer it cannot be reduced to a metallic form, though like the latter it may be precipitated by phlogisticated alkali. In many of its properties it much resembles the calx of lead, and in others the common calcareous earth. Its most remarkable properties are its decomposing the vitriolic neutral salts, and forming, with the nitrous and marine acids, crystals which do not deliquesce.

### § 2. *Transmutation of* FLINTS *into an* EARTH *soluble in Acids.*

1069 Solution of flint.

THIS is effected by mixing powdered flints with alkaline salt, and melting the mixture by a strong fire. The melted mass deliquates in the air, like alkaline salts; and if the flint is then precipitated, it becomes soluble in acids, which it entirely resisted before.

In this process the alkali, by its union with the flint, is deprived of its fixed air, and becomes caustic. To this causticity its solvent power is owing; and therefore the flint may be precipitated from the alkali, not only by acids, but by any substance capable of furnishing fixed air; such as magnesia alba or volatile alkali. The precipitate in both cases proves the same; but the nature of it hath not hitherto been determined. Some have conjectured that the vitriolic acid existed in the flint; in which case, the alkali made use of in this process ought to be partly converted into vitriolated tartar.

1070 Solubility of this earth denied by Mr Bergman.

The above process is delivered on the authority of former chemists; but Mr Bergman, who has published a dissertation on this subject, asserts that it cannot be dissolved except by the fluor acid. The vitriolic, nitrous, or marine acids, have no effect upon it, even when newly precipitated from the liquor of flints washed and still wet, and though a thousand parts of acid be added to one of the earth, and boiled upon it for an hour: but when three parts of alkaline salt are melted in a crucible with one of quartz, the salt dissolves at the same time about seven hundreth parts of its own weight of the clay which composes the crucible; and the solubility of this has given occasion to the mistake abovementioned. If the fusion be performed in an iron vessel, no soluble part will be obtained, excepting the very small portion of clay which the quartz contains; and when this is once exhausted by an acid, no more can be procured by any number of fusions with alkali.

1071 Reason of the mistake of former chemists.

1072 Crystals of flint artificially formed by Mr Bergman.

The fluor acid, he observes, is never obtained entirely free from siliceous earth, and consequently its power as a menstruum must be weakened in proportion to the quantity it contains. In order to observe its solvent power, however, our author, in the year 1772, put some quartz, very finely powdered, into a bottle containing $\frac{1}{8}$ of a kanne of fluor acid. The bottle was then slightly corked, and set by in the corner of a room. Two years afterwards it was examined; and on pouring out the liquor there were found concreted at the bottom of the vessel, besides innumerable small prismatic spiculae, 13 crystals of the size of small peas, but mostly of an irregular form. Some of these resembled cubes, whose angles were all truncated, such as are often found in the cavities of flints. These were perfect siliceous crystals, and very hard, but not comparable with quartz, though they agreed with it in essential properties. "Possibly (says he) the length of a century may be necessary for them to acquire, by exsiccation, a sufficient degree of hardness. The bottom itself, as far as the liquor had reached, was found covered with a very thin siliceous pellicle, which was scarcely visible, but separated on breaking the bottle. It was extremely pellucid, flexible, and showed prismatic colours. These phenomena show that much siliceous matter is dissolved and suspended." (in the fluor acid). "Whether any of the quartz was taken up in this experiment is uncertain; but it appears probable that little or none was dissolved; since, by the help of heat during the distillation, the acid had previously taken up so much siliceous earth, that upon slow evaporation it was unable to retain it. Hence appears the origin of the crystals and the pellicle; and hence appears the cause which impedes the action of fluor acid upon flint; namely, that the acid obtained in the ordinary way is already saturated with it.

Transmutation of flints into an earth soluble in acids.

1073 Why the fluor acid will not dissolve flint directly.

1074 Siliceous earth most completely precipitated by volatile alkali.

The volatile alkali precipitates siliceous earth most completely from fluor acid: and thus we find, that one part of it is contained in 600 of the acid, diluted to such a degree, that its specific gravity is only 1.064. This precipitate has all the properties of pure flint; but that precipitated either by vegetable or mineral fixed alkali does not afford a pure siliceous earth, but a peculiar kind of triple salt, formed of the earth, fluor acid, and fixed alkali, which dissolves, though with difficulty, in warm water, especially the earth procured by vegetable alkali, but is easily decomposed by lime-water and lets fall the mineral fluor regenerated.

1075 A triple salt formed by precipition with fixed alkali.

1076 Siliceous earth dissolved by boiling in solution of alkali.

Fixed alkaline salts attack this earth by boiling, but not unless it be reduced to very fine powder, and newly precipitated from the liquor. Oil of tartar per deliquium takes up about one-sixth of its weight, and the liquor becomes gelatinous on cooling, though at first diluted with 16 times its weight of water. This solution is effected only by the caustic part; for when fully saturated with fixed air, it cannot enter into any union with it. Volatile alkali, even though caustic, has no effect.

1077 Has a remarkable attraction for it in the dry way.

The attraction betwixt siliceous earth and fixed alkali is much more remarkable in the dry way; for thus it melts with one half its weight of alkali into an hard, firm, and transparent glass, the aerial acid and water going off in a violent effervescence. In proportion as the alkali is increased, the glass becomes more soft and lax, until at last it dissolves totally in water, as has been already mentioned. The siliceous matter thus precipitated is of a very rare and spongy texture, and so much swelled by water, and its bulk when wet is at least twelve times greater than when dry; nor does it contract more though suffered to remain a long time in the water. Hence it is easy to reduce the liquor of flints to a jelly, by diluting it with four or eight times its weight of water, and adding a sufficient quantity of precipitate; but if an over-proportion of water be used, for instance, 24 times the weight, the liquor will then remain limpid though we add as much acid as is sufficient for saturating the alkali. The reason of this Mr Bergman supposes to be, that the siliceous particles are removed to such a distance from one another, that they cannot overcome the

1078 Is very rare and spongy when precipitated.

1079 Why it cannot sometimes be precipitated by an acid without heat.

*Phosphoric earths.*

the friction they must necessarily meet with in their passage downwards through the fluid; but if the liquor be boiled, which at once diminishes its quantity and tenacity, the siliceous matter is instantly separated.

1080
*Liquor of flints decomposed by too great a quantity of water, and by fluor acid.*

Liquor of flints is also decomposed by too great a quantity of water; for by this the efficacy of the menstruum is weakened, and it is also partly saturated by the aerial acid contained in the water. A precipitate also falls when the fluor acid is made use of; the reason of which is the same as the precipitation by other acids: in this case, however, the alkali makes part of the precipitate, as has been already observed; and therefore the matter which falls is fusible before the blowpipe, and soluble in a sufficient quantity of water.

### § 3. *Of* Phosphoric *Earths.*

1081
*Bolognian stone.*

These are so called from their property of shining in the dark. The most celebrated and anciently known of this kind is that called the *Bolognian stone*, from Bologna, a city in Italy, near which it is found. The discovery, according to Lemery, was accidentally made by a shoe-maker called *Vincenzo Casciarolo*, who used to make chemical experiments. This man, having been induced to think, from the great weight and lustre of these stones, that they contained silver, gathered some, and calcined them; when carrying them into a dark place, probably by accident, he observed them shining like hot coals.

Mr Margraaf describes the Bolognian stone to be an heavy, soft, friable, and crystallized substance, incapable of effervescence with acids before calcination in contact with burning fuel. These properties seem to indicate this stone to be of a selenitic or gypseous nature.

1082
*How rendered luminous.*

When these stones are to be rendered phosphoric, such of them ought to be chosen as are the cleanest, best crystallized, most friable and heavy; which exfoliate when broken, and which contain no heterogeneous parts. They are to be made red hot in a crucible; and reduced to a very fine powder in a glass-mortar, or upon a porphyry. Being thus reduced to powder, they are to be formed into a paste with mucilage of gum tragacanth, and divided into thin cakes. These are to be dried with a heat, which at last is to be made pretty considerable. An ordinary reverberating furnace is to be filled to three quarters of its height with charcoal, and the fire is to be kindled. Upon this charcoal the flat surfaces of the cakes are to rest, and more charcoal to be placed above them, so as to fill the furnace. The furnace is then to be covered with its dome, the tube of which is to remain open; all the coal is to be consumed, and the furnace is to be left to cool; the cakes are then to be cleansed from the ashes by blowing with bellows upon them. When they have been exposed during some minutes to light, and afterwards carried to a dark place, they will seem to shine like hot coals; particularly if the person observing them has been some time in the dark, or have shut his eyes, that the pupils may be sufficiently expanded. After this calcination through the coals, if the stones be exposed to a stronger calcination, during a full half hour, under a muffle, their phosphoric quality will be rendered stronger.

From attending to the qualities of this stone, and the requisites for making this phosphorus, we are naturally led to think, that the Bolognian phosphorus is no other than a composition of sulphur and quicklime. The stone itself, in its natural state, evidently contains vitriolic acid, from its not effervescing with acids of any kind. This acid cannot be expelled from earthy substances by almost any degree of fire, unless inflammable matter is admitted to it. In this case, part of the acid becomes sulphureous, and flies off; while part is converted into sulphur, and combines with the earth. In the abovementioned process, the inflammable matter is furnished by the coals in contact with which the cakes are calcined, and by the mucilage of gum tragacanth with which the cakes are made up. A true sulphur must therefore be formed by the union of this inflammable matter with the vitriolic acid contained in the stone; and part of this sulphur must remain united to the earth left in a calcareous state, by the dissipation, or conversion into sulphur, of its acid.

1083
*Analysis of the phosphorus.*

1084
*All calcareous stones phosphoric, according to Mr du Fay.*

In the year 1730, a memoir was published by Mr du Fay; wherein he asserts, that all calcareous stones, whether they contain vitriolic acid or not, are capable of becoming luminous by calcination: with this difference only, that the pure calcareous stones require a stronger, or more frequently repeated, calcination to convert them into phosphorus; whereas those which contain an acid, as selenites, gypsum, spars, *&c.* become phosphoric by a slighter calcination. On the contrary, Mr Margraaf asserts, that no other stones can be rendered phosphoric but those which are saturated with an acid; that purely calcareous stones, such as marble, chalk, limestone, stalactites, *&c.* cannot be rendered luminous, till saturated with an acid previously to their calcination.

1085
*Signior Beccaria's observation.*

We have already taken notice, that the compounds formed by uniting calcareous earths with the nitrous and marine acids become a kind of phosphori; the former of which emits light in the dark, after having been exposed to the sun through the day; and the latter becomes luminous by being struck. Signior Beccaria found, that this phosphoric quality was capable of being given to almost all substances in nature, metals perhaps excepted. He found that it was widely diffused among animals, and that even his own hand and arm possessed it in a very considerable degree.

1086
*Mr Wilson's experiments.*

In the year 1775, a treatise on this kind of phosphori was published by B. Wilson, F. R. S. and member of the Royal Academy at Upsal. In this treatise he shows, that oyster-shells, by calcination, acquire the phosphoric quality in a very great degree, either when combined with the nitrous acid or without it.

The first experiment made by our author was the pouring some aquafortis, previously impregnated with copper, on a quantity of calcined oyster-shells, so as to form them into a kind of paste; he put this paste into a crucible, which was kept in a pretty hot fire for about 40 minutes. Having taken out the mass, and waited till it was cool, he presented it to the external light. On bringing it back suddenly into the dark, he was surprised with the appearance of a variety of colours like those of the rainbow, but much more vivid. In consequence of this appearance of the prismatic colours, Vegetable earth.

colours, he repeated the experiment in various ways, combining the calcined oyster-shells with different metals and metallic solutions, with the different acids, alkaline and neutral salts, as well as with sulphur, charcoal, and other inflammable substances; and by all of these he produced phosphori, which emitted variously coloured light.

1087 Surprising phosphoric quality of oyster-shells.

What is more remarkable, he found that oyster-shells possessed the phosphoric quality in a surprising degree; and for this purpose nothing more was requisite than putting them into a good sea-coal fire, and keeping them there for some time. On scaling off the internal yellowish surface of each shell, they become excellent phosphori, and exhibit the most vivid and beautiful colours. As we know that neither the vitriolic nor any other acid is contained in oyster-shells, we cannot as yet say any thing satisfactory concerning the nature of this phosphorus.

### § 4. *Of the* Vegetable *Earth.*

1088 DrLewis's opinion.

This is produced from vegetables by burning, and, when perfectly pure, by lixiviating the ashes with water, to extract the salt; and then repeatedly calcining them, to burn out all the inflammable matter; and is perhaps the same from whatever substance it is obtained: in this state, according to Dr Lewis, it is of the same nature with magnesia. In the state, however, in which this earth is procurable by simply burning the plant, and lixiviating the ashes, it is considerably different, according to the different plants from which it is obtained.

1089 Mr Gmelin's experiments.

The ashes of mugwort, small centaury, chervil, and dill, are of a brownish grey; goat's beard and lungwort afford white ashes; those of sanicle are whitish; those of Roman wormwood of a greenish grey; those of rue, agrimony, saxifrage, brown; those of tansey, of a dusky green; those of dodder, of a fine green; eyebright, southern-wood, common wormwood, and scabious, afford them grey; scurvy-grass, of a whitish grey; hyssop, yarrow, and sowbane, of a dusky grey; melilot, and oak-leaves, as also plantain, colts-foot, pine-tops, and fumitory, of a dusky brown; penny-royal, of a pale brown, with some spots of white; elder-flowers, sage, and mother of thyme, afford yellow ashes; those of strawberry-leaves are of a pale brimstone colour; those of cat-mint, of a dusky red; of prunella, brick-coloured; of honey-suckle, blue; of fern, blackish; and those of St John's wort, feverfew, origanum, and pimpernel, all of a deep black. The only use to which this kind of earth has yet been put, is that of glass-making and manure.

## Sect. III. *Of Metallic Substances.*

### § 1. *Gold.*

This metal is reckoned of all others the most perfect and indestructible. When in its greatest purity, it has very little elasticity, is not sonorous, its colour is yellow, it is exceedingly soft and flexible, and is more ductile than any other metal whatever. (See Gold *Leaf*, and Wire-Drawing.) Of all bodies it is the most ponderous, except platina; its gravity being to that of water, according to Dr Lewis, as 19,280, or 19,290, to one. For its fusion it requires a low degree of white heat, somewhat greater than that in which silver melts. Whilst fluid, it appears of a bluish green colour; when cold, its surface looks smooth, bright, and considerably concave: it seems to expand more in the act of fusion, and to shrink more in its return to solidity, than any of the other metals; whence the greater concavity of its surface. Before fusion it expands the least of all metals, except iron. By sudden cooling it becomes, as well as other metals, brittle; which effect has been erroneously attributed to the contact of fuel during fusion.

Gold.

1090 Unites readily with all the metals.

Gold amalgamates very readily with mercury, and mingles in fusion with all the metals. It is remarkably disposed to unite with iron; of which it dissolves many times its own weight, in a heat not much greater than that in which gold itself melts; the mixture is of a silver colour, very brittle and hard. All the metals, except copper, debase the colour of gold; and, if their quantity is nearly equal to that of the gold, almost entirely conceal it.

1091 Said to lose its malleability remarkably with tin.

The malleability of gold is impaired by all the metals, but less by copper and silver than any others. Tin has had a remarkably bad character in this respect; and it has been a received opinion among metallurgists, that the smallest quantity of this metal entirely destroys the ductility of gold; and Dr Lewis tells us, that "the most minute portion of tin or lead, and even the vapours which rise from them in the fire, though not sufficient to add to the gold any weight sensible on the tenderest balance, make it so brittle, that it flies to pieces under the hammer."

1092 Mr Alchorne's experiments in opposition.

On so respectable an authority, this continued to be believed as an undoubted fact, until, in the year 1784, a paper appeared in the Philosophical Transactions by Mr Alchorne of the mint: in which it was clearly disproved by the following experiments:

1. Sixty Troy grains of pure tin were put into 12 ounces of pure gold in fusion; after which the mixture was cast into a mould of sand, producing a flat bar an inch wide, and an eight of an inch thick. The bar appeared sound and good, suffered flatting under the hammer, drawing several times between a pair of steel-rollers, and cutting into circular pieces of near an inch diameter, which bore stamping in the money-press by the usual stroke, without showing the least brittleness, or rather with much the same ductility as pure gold.

2. With 90 grains of tin the bar was scarce distinguishable from the former.

3. With 120 grains it was rather paler and harder; and on drawing between the rollers the edges were a little disposed to crack.

4. With 140 grains, the paleness, hardness, and disposition to crack, were evidently increased; nevertheless it bore every other operation, even stamping under the press, without any apparent injury.

5. With an ounce of tin the bar was lead-coloured and brittle, splitting into several pieces on the first passing between the rollers.

1093 Gold not rendered brittle by the fumes of tin.

6. A small crucible filled with standard gold $\frac{11}{12}$ fine, was placed in a larger one, having in it an ounce of melted tin. The whole was covered with a large crucible inverted, in order to direct the fumes of the tin downward upon the gold. The metals were kept in fusion

fusion for half an hour, during which time a full quarter of the tin was calcined; yet the gold remained altogether unchanged.

7. The mixture of gold and tin produced in exp. 1. was melted a second time in a stronger fire than at first, and kept in fusion for half an hour; during which time six grains of weight were lost, but the gold remained equally perfect as before.

1094 Nor by the addition of copper.

8. and 9. The mixtures of exp. 2. and 4. viz. 90 and 140 grains to 12 ounces of gold, were re-melted separately, and an ounce of copper added to each. On being cast as usual, they bore all the operations of manufacturing as before, though sensibly harder. The last cracked at the edges as it had done without the copper, but bore cutting rather better than in its former state.

10. and 11. A quarter of an ounce of the last mixture, being tin 140 grains, and copper an ounce, and gold 12 ounces, with as much of the bar from experiment 3. consisting of 140 grains of tin to 12 ounces of gold, were each melted by a jeweller in a common sea-coal fire, into small buttons, without any loss of weight. These buttons were afterwards forged into small bars, nealing them often with the flame of a lamp, and afterwards drawn each about twenty times through the apertures of a steel plate, into fine wire, with as much ease as coarse gold commonly passes the like operation.

12. Sixty grains of tin were added to 12 ounces of standard gold $\frac{11}{12}$ fine; and the compound passed every one of the operations already described, without showing the least alteration from the tin.

Several other trials were made with different mixtures of copper, tin, and silver, with gold, even as low as two ounces and a half of copper, with half an ounce of tin, to twelve ounces of gold; all of which bore hammering and flatting by rollers to the thinness of stiff paper, and afterwards working into watch-cases, cane-heads, &c. with great ease. They grew more hard and harsh indeed in proportion to the quantity of alloy; but not one of them had the appearance of what workmen call brittle gold. Mr Alchorne therefore is of opinion, that when brittleness has been occasioned by the addition of tin to gold, the former has been adulterated with arsenic; as he has found, that by adding 12 grains of regulus of arsenic to as many ounces of fine gold, the compound has been rendered altogether unmalleable,

1095 Malleability of gold destroyed by regulus of arsenic.

When gold is struck during a certain time by a hammer, or when violently compressed, as by the wire-drawers, it becomes more hard, elastic, and less ductile; so that it is apt to be cracked and torn. Its ductility is, however, restored by the same means used with other metals, namely, heating it red hot, and letting it cool slowly. This is called *annealing* metals; and gold seems to be more affected by this operation than any other metal. The tenacity of the parts of gold is also very surprising; for a wire of $\frac{1}{10}$ of an inch in diameter will support a weight of 500 pounds.

1096 Surprising tenacity of its parts.

1097 Not liable to rust.

Gold is unalterable by air or water. It never contracts rust like other metals. The action of the fiercest furnace-fires occasions no alteration in it. Kunckel kept gold in a glass-house furnace for a month, and Boyle kept some exposed to a great heat for a still longer time, without the loss of a single grain. It is said, however, to be dissipable in the focus of a large burning mirror.

1098 Mr Boyle's experiments for the destructibility of gold.

Mr Boyle relates a very curious and extraordinary experiment, which he thought was sufficient to prove the total destructibility of gold. About an eighth part of a grain of powder, communicated by a stranger, was projected upon two drachms of fine gold in fusion, and the matter kept melted for a quarter of an hour. During the fusion, it looked like ordinary gold; except only once, that his assistant observed it to look exactly of the colour of opal. When cold, it was of a dirty colour, and, as it were, overcast with a thin coat, almost like half-vitrified litharge: the bottom of the crucible was overlaid with a vitrified substance, partly yellow, and partly reddish brown; with a few small globules, more like impure silver than gold. The metal was brittle, internally like brass or bell-metal; on the touchstone more like silver than gold: its specific gravity was to that of water only as $15\frac{2}{3}$ to 1. There was no absolute loss of weight. By cupellation, 60 grains of this mass yielded 53 grains of pure gold, with seven grains of a ponderous, fixed, dark-coloured substance.

1099 Solution in aqua-regia.

We have already mentioned, that in certain circumstances gold is soluble in the nitrous and marine acids separately. It is, however, always soluble by the two united, but dissolves slowly even then. The most commodious method of obtaining this solution is, by putting the gold, either in leaves, or granulated, or cut into small thin pieces, into a proper quantity of aquafortis; then adding, by degrees, some powdered sal ammoniac, till the whole of the gold is dissolved. By this means a much smaller quantity of the menstruum proves sufficient, than if the sal ammoniac was previously dissolved in the aquafortis; the conflict, which each addition of the salt raises with the acid, greatly promoting the dissolution. Aquafortis of moderate strength will, in this way, take up about one-third of its weight of gold; whereas an aqua-regis, ready prepared from the same aquafortis, will not take up above one-fifth its weight. Common salt answers better for the preparation of the aqua-regis than sal ammoniac.

1100 Properties of the solution.

This solution, like all other metallic ones, is corrosive. It gives a violet colour to the fingers, or to any animal matters. If the solution is evaporated and cooled, yellow transparent crystals will be formed: but, if the evaporation is carried too far, the acids with which the gold is combined may be driven from it by heat alone; and the gold will be left in the state of a yellow powder, called *calx of gold*.

1101 Gold precipitated from it.

Gold may be precipitated from its solution by those substances which commonly precipitate metals, such as alkaline salts and calcareous earths. It may also be precipitated in a fine purple powder, by tin or its solution.

When fixed alkalies are made use of, the precipitate weighs about one-fourth more than the gold employed. With volatile alkalies also, if they are added in no greater proportion than is sufficient to saturate the acid, the quantity of precipitate proves nearly the same: but if volatile spirit is added in an over-proportion, it redissolves part of the gold which it had before precipitated, and the liquor becomes again considerably yellow. The whole of the precipitate, however, Gold.

ever, could not be rediſſolved, either by the mild or cauſtic alkali; nor did either of theſe ſpirits ſenſibly diſſolve or extract any tinge from precipitates of gold which had been thoroughly edulcorated with boiling water.

All the metallic bodies which diſſolve in aqua-regia, precipitate gold from it. Mercury and copper throw down the gold in its bright metalline form; the others, in that of a calx or powder, which has no metallic aſpect. Vitriol of iron, though it precipitates gold, yet has no effect upon any other metal; hence it affords an eaſy method of ſeparating gold from all other metals. The precipitation with tin ſucceeds certainly only when the metal in ſubſtance is uſed, and the ſolution of gold largely diluted with water. It is obſervable, that though the gold is precipitated from the diluted ſolution by tin, yet, if the whole is ſuffered to ſtand till the water has in a great meaſure exhaled, the gold is taken up afreſh, and only a white calx of tin remains.

1102 Separated from other metals by vitriol of iron.

1103 Aurum fulminans.

Gold precipitated from its ſolution in aqua-regia explodes by heat with much greater violence than any other ſubſtance in nature. This property was known in the 15th century; but whether the ancient alchemiſts knew any thing of it or not, is a matter of uncertainty. Baſil Valentine firſt gave any diſtinct account of it. He directs the gold to be diſſolved in aqua-regia made with ſal ammoniac, and then precipitated by vegetable fixed alkali, to be twelve times waſhed with water, and laſtly dried in the open air, where the ſun's rays cannot reach it. He forbids it to be dried over a fire, as it explodes with a gentle heat, and flies off with inconceivable violence.

1104 Known in the 15th century.

1105 Baſil Valentine's directions for its preparation.

Succeeding chemiſts have performed this operation with ſome little differences; but the neceſſity of employing volatile alkali was but little regarded till the beginning of the preſent century.

1106 Uſe of volatile alkali but lately known.

The calx of gold is always ſomewhat increaſed in weight by being converted into aurum fulminans; but authors are not agreed about the quantity of augmentation. Becher makes it heavier by one-fifth part; Lemery by one-fourth; and Juncker by one-fourth. All agree, however, that it explodes with a violence almoſt inconceivable. Crollius relates, that 20 grains of this powder explodes with more force than half a pound of gun powder, and exerts its force downwards, though M. Teykmeyer frequently ſhowed in his lectures that it would throw a florin upwards above ſix ells. A great number of experiments were made before the Royal Society at London, in order to determine the comparative forces of theſe two powders. Equal parts of gunpowder and aurum fulminans were included in iron globes placed among burning coals; thoſe which contained the former burſt with great violence, but the globes containing the aurum fulminans remained perfectly ſilent. But though no exploſion takes place in cloſe veſſels, the utmoſt caution is neceſſary in managing this ſubſtance in the open air; eſpecially when it is ſubjected to friction, or to a ſlight degree of heat; for ſuch is the nature of the calx we ſpeak of, that it is not neceſſary, in order to cauſe it explode, to touch it with an ignited ſubſtance, or to make it red-hot. The heat requiſite for this purpoſe is, according to Dr Lewis, intermediate between that of boiling water and the heat which makes metals of an obſcure red. With friction, however, it ſeems ſtill more dangerous; for in this caſe it explodes with what we ſhould think ſcarce ſufficient to communicate any degree of heat whatever. Orſchal relates, that this powder ground in a jaſper mortar, exploded with ſuch violence as to burſt the veſſel in a thouſand pieces; Dr Lewis gives an inſtance of a ſimilar kind in England; and Dr Birch tells us of doors and widows torn to pieces by the violence of this exploſive matter. Mr Macquer relates the following accident to which he was witneſs. "A young man, who worked in a laboratory, had put a drachm of fulminating gold into a bottle, and had neglected to wipe the inner ſurface of the neck of the bottle, to which ſome of the powder adhered. When he endeavoured to cloſe the bottle, by turning round the glaſs ſtopper, the friction occaſioned an exploſion of part of the powder. By this the young man was thrown ſome ſteps backward, his face and hands wounded by the fragments of the bottle, and his eyes put out; yet, notwithſtanding this violent exploſion, the whole drachm of fulminating gold certainly did not take fire as much of it was afterwards found ſcattered about the laboratory."

1107 Increaſe of the weight of gold by being changed into aurum fulminans.

1108 Prodigious force with which it explodes.

1109 Does not explode in cloſe veſſels.

1110 Heat requiſite for the exploſion.

1111 Explodes readily by friction.

1112 Inſtances of its miſchievous effects.

It has already been mentioned, that ſome imagine the force of this exploſion to be directed downwards; but Dr Lewis is of opinion that it is equally directed every way. Certain it is, that the quantity of from 10 to 12 grains of aurum fulminans, exploded on a metalline plate, lacerates it; a ſmaller quantity forms a cavity, and a ſtill ſmaller only ſcratches the ſurface; effects which are never produced by gunpowder in ever ſo large a quantity. A weight laid upon the powder is thrown upwards in the moment of exploſion. If it be of ſilver or copper, this weight is marked with a yellowiſh ſpot, as the ſupports will alſo be, if made of either of theſe metals. A large grain, ſays Mr Bergman, brought near to the ſide of the flame of a candle, blows it out with great noiſe; and a few ounces exploding together by incautious drying, has been known to ſhatter the doors and windows of the apartment: hence it is evident, that aurum fulminans exerts its force in all directions; yet it cannot be denied, that it ſtrikes bodies with which it is in contact more violently than thoſe which are at a ſmall diſtance, though in its vicinity: thus, if a ſmall portion of it explodes in a paper box, it lacerates only the bottom, unleſs the top be preſſed down cloſe, in which caſe it perforates both the top and bottom. When carefully and gradually exploded in a glaſs phial or a paper box, it leaves a purple ſoot, in which are found many particles of ſhining gold; and if the quantity exploded be large, ſeveral grains remain totally unchanged, as it is only the lowermoſt ſtratum that is inflamed.

1113 Force of the exploſion is not directed entirely downwards.

Aurum fulminans, when moiſt, does not explode at all: but as it dries, the grains go off in ſucceſſion like the decrepitation of common ſalt.—In glaſs veſſels cloſed, or with their mouths immerſed in water, it explodes, but with a very weak report. An elaſtic vapour, in the quantity of ſeven inches, from half a drachm of the powder, broke forth in the moment of exploſion, which, by our author's account, ſeems to be phlogiſticated air. In metallic veſſels ſufficiently ſtrong, the gold is ſilently reduced when they are perfectly

1114 Exploſion of moiſt aurum fulminans.

Gold

fectly sound; but if they have any very small chinks in them, the vapour makes its way through them with a hissing noise.

1115 Cause of this explosion attributed to a saline principle.

The cause of this extraordinary explosive force of gold has been attributed chiefly to a saline principle, *viz.* The combination of nitrous acid with volatile alkali; and this opinion has been supported by an assertion, that the fulminating property is destroyed by treating the calx with vitriolic acid or with fixed alkali; the former expelling the nitrous acid, and the latter disengaging the volatile alkali. Mr Bergman allows that fixed alkali destroys the fulminating property; but affirms, that it acts only by separating the particles when the two are triturated together; and this might be done by many other substances as well as fixed alkali: But when the alkali, instead of being triturated in the dry way with the calx, was boiled in water along with it, the explosion not only took place, but was much more violent than usual. It must be observed, however, that heat alone destroys the fulminating property of this calx; and therefore, if the alkaline solution be made too strong, the additional heat which it then becomes capable of sustaining, is sufficient to deprive the calx of its fulminating property. The case is the same with the vitriolic acid; for this has no effect upon the calx, either by digestion in its concentrated state, or by boiling in its diluted state. If it be boiled in its concentrated state indeed with the fulminating calx, the heat conceived by the acid is sufficient to destroy the fulminating property of the former; and in like manner, unless the calx be in some measure destroyed, or reduced to its metallic state, it can never be deprived of its fulminating property.

1116 This opinion shown to be erroneous by Mr Bergman.

1117 Aurum fulminans can be made without nitrous or marine acids.

It was further proved, that the fulminating property did not depend on the presence either of nitrous or marine acids, for it can be made without them. A calx of gold, not fulminating, dissolved in vitriolic acid, and precipitated by caustic volatile alkali, had acquired this property. A solution of the same calx in nitrous acid, let fall a precipitate by the addition of pure water; and this precipitate edulcorated, and digested with volatile alkali, fulminated as if it had been originally precipitated with that alkali. The experiment was repeated on the other non-fulminating precipitates with the same success. Lest any suspicion, however, should remain, that a small quantity of aqua-regia might still be left, which, by combining with the volatile alkali, would make a proportionable quantity of nitrum flammans, the precipitate was digested 24 hours in vitriolic acid, then washed in pure water, and immersed in aqueous and spirituous solutions of alkali, both mild and caustic; but the event was the same. Lastly, an inert calx of gold may always be made to fulminate by digesting it with volatile alkali; nor can this property be communicated to it by any means without the use of this alkali.

1118 Fixed air not the cause of the explosion.

It has been supposed by some very eminent chemists, among whom we may number Dr Black, that fixed air is the cause of the fulmination of gold: but it is evident that this cannot be the case: because, 1. Gold fulminates as well when precipitated by the caustic volatile alkali, as by that which contains fixed air, 2. This metal does not combine, during precipitation, with fixed air. 3. Gold, when precipitated by mild fixed alkali, does not fulminate, unless the menstruum contain volatile alkali.

The fulminating calx of gold may be prepared either with the compound aqua-regia of pure nitrous and marine acids; of pure nitrous acid and sal ammoniac; or of a compound of alum, nitre, and sea-salt. When this kind of liquor is made use of, the acid of the alum expels the other two, and thus forms an aqua-regia. This was formerly called *menstruum sine strepitu*. By whatever method the gold is dissolved, it always affords a yellow calx with alkalies, but the volatile alkali most readily throws down the metal. Dephlogisticated spirit of salt very readily dissolves gold, and produces a fulminating precipitate as well as aqua-regia.

1119 Menstruum sine strepitu.

1120 Mr Bergman's theory of the cause of the explosion.

We shall conclude this account of aurum fulminans with an abstract of Mr Bergman's theory of the explosion.—He observes, that volatile alkali contains phlogiston; an undoubted proof of which is given by Dr Priestley, by coverting alkaline into phlogisticated air. This phlogiston, says he, may be separated by means of a superior attraction; so that the volatile alkali is decomposed, and the residuum dissipated in form of an elastic fluid, altogether similar to that which is extricated during the fulmination: the source then from whence the elastic fluid is derived must be obvious; and it only remains to examine the medium by which the volatile alkali is dephlogisticated.

"In those metals which are called *perfect*, so great is the firmness of texture, and so close the connection of the earthy principle with the phlogiston, that by means of fire alone these principles cannot be disunited: but when dissolved by acid menstrua, they must necessarily lose a portion of their phlogiston; and therefore, when afterwards precipitated by alkalies which cannot supply the loss, they fall down in a calcined state, though they attract phlogiston so strongly, that they can be reduced to a metallic state, merely by an intense heat penetrating the vessels. It may therefore be laid down as a fundamental position, that gold is calcined by solution.

1121 Volatile alkali the cause of the explosion.

"Let us now consider the consequence of exposing the powder consisting of calx of gold and volatile alkali intimately united, to an heat gradually increased. The calx which is united with the volatile alkali, by the assistance of a gentle heat, seizes its phlogiston; and when this is taken away, the residuum of the salt is instantaneously expanded into the form of an elastic fluid, which is performed with so much violence, that the air must yield a very acute sound."

1122 Volatile alkali exhibits a flash when thrown into a hot crucible.

Our author proceeds to explain this phenomenon upon the principles assumed by him and Mr Scheele, of heat being a composition of light, and the phlogiston or principle of inflammability; but as this hypothesis is by no means satisfactory, we shall omit his reasoning founded upon it: That the volatile alkali, however, is really capable of producing a flash is easily proved, because it exhibits one when thrown into a hot crucible. A single cubic inch of gun-powder generates about 244 of elastic fluid; but the same quantity of aurum fulminans yields at least four times as much; and hence we may easily understand the difference in their explosive force.

1123 Great quantity of elastic fluid produced by aurum fulminans.

"That careful calcinations should destroy the fulmi-

1124 Why slight calcination destroys the fulminating property.

minating property, is not to be wondered at, as the volatile alkali is the indispensible material cause; but, the peculiar alacrity which it acquires before the explosive force is totally extinguished, depends upon the nature of the materials, and of the operation. Thus the heat, when inferior to that necessary for fulmination, acts upon both the principles of the aurum fulminans, it prepares the metallic calx for a more violent attraction for phlogiston; it also acts upon the phlogiston of the volatile alkali, and lessens its connection; which two circumstances must tend to the union producing the explosion. But this effect has a maximum; and at this period the slightest friction supplies the defect of necessary heat, and produces the fulmination. The calcined gold also seems to collect and fix the matter of heat, though still insufficient by means of its phlogiston, in a certain degree; so that by means of friction, though but very slight, it becomes capable of exerting its force; but when the heating is ofen repeated without procuring its effect, the volatile alkali is by degrees dissipated, and at length so much diminished that the calx becomes inert.

1125 Why it will not explode in close vessels.

"But if aurum fulminans is capable of producing such a prodigious quantity of elastic fluid, how does it happen that it remains mute and inert when reduced in close vessels? Of this the reason may be, that every elastic fluid, in the act of breaking forth, requires a space to expand in; and if this be wanting, it remains fixed. Taking this for granted, a calx of gold cannot be reduced in close vessels either by heat or by the phlogiston of volatile alkali; for in either case it must evolve its elastic fluid, which by supposition it cannot do. Nothing remains to solve this difficulty but the ignition of the surrounding metal; by means of which the calx, in virtue of its superior attraction, seizes the phlogiston of the metal, which that substance here, as well as in other instances, is capable of losing without the eruption or absorption of any fluid whatever."

1126 Mr Bergman's opinions of the fublimation of other calces.

Several chemists have asserted, that the calces of copper or silver may be made to fulminate like that of gold. But Mr Bergman informs us, that these experiments never succeeded with him; "so (says he) they have either been silent upon some circumstances necessary in the operation, or perhaps have been deceived by the detonation of nitrum flammans, or some other accidental occurrence. It is not sufficient for the volatile alkali to adhere to the precipitate; for platina thrown down by this alkali retains a portion of it very obstinately, but yet does not fulminate on the exposure of fire —Besides the presence of volatile alkali, it seems to be necessary that the metallic calx should be reducible by a gentle heat, in order to decompose it; but every explosion is not to be derived from the same causes; nay, in this respect, aurum fulminans, gun-powder, and pulvis fulminans, differ very much, though they agree in several particulars." Of late, however, it has been found that the calx of silver may be made to fulminate in a manner still more extraordinary than that of gold. See the next article.

1127 Solution of gold by hepar sulphuris.

If gold is melted with an hepar sulphuris, composed of equal parts of sulphur and fixed alkaline salt, the metal readily unites with it into an uniform mass, capable of dissolution in water without any separation of its parts. The solution, besides a nauseous taste from the sulphur, has a peculiar penetrating bitterness, not discoverable in any other metalline solution made by the same means.

Though the compositions of sulphur and alkali seem to unite more intimately with gold than any other metal, their affinity with it is but slight; copper, or iron, added to the matter in fusion, disunite, and precipitate the gold. The metal thus recovered, and purified by the common processes, proves remarkably paler-coloured than at first. In an experiment related by Dr Brandt, in the Swedish Memoirs, the purified gold turned out nearly as pale as silver, without any diminution of weight.

1128 Medicinal virtues of gold.

Gold has been thought to be possessed of many extraordinary virtues as a medicine; which, however, are long ago determined to be only imaginary. It is not indeed very easy to prepare this metal in such a manner that it can be safely taken into the human body. The solution in aqua-regia is poisonous; but if any essential oil is poured on this solution, the gold will be separated from the acid, and united to the essential oil; with which, however, it contracts no lasting union, but in a few hours separates in bright yellow film to the sides of the glass.

1129 Etheral solution.

Vitriolic ether dissolves the gold more readily and perfectly than the common essential oils; and keeps it permanently suspended, the acid liquor underneath appearing colourless. The yellow ethereal solution poured off, and kept for some time in a glass stopt with a cork, so that the spirit may slowly exhale, yields long, transparent, prismatic crystals, in shape like those of nitre, and yellow like topaz. What the nature of these crystals is, either as to medicinal effects, or other purposes, is as yet unknown.

Rectified spirit of wine mingles uniformly with the solution of gold made in acids: if the mixture is suffered to stand for some days in a glass slightly covered, the gold is by degrees revived, and arises in bright pellicles to the surface. Grosser inflammable matters, wine, vinegar, solutions of tartar, throw down the gold, in its metallic form, to the bottom. Gold is the only metal which is thus separable from its solution in acids by these substances; and hence gold may be purified by these means from all admixtures, and small proportions of it in liquors readily discovered.

1130 Colour of gold restored.

When the colour of gold is by any means rendered pale, it may be recovered again by melting it with copper, and afterwards separating the copper; or by a mixture of verdigris and sal ammoniac with vitriol or nitre. The colour is also improved by fusion with nitre, injecting sal ammoniac upon it in the fusion, quenching it in urine, or boiling it in a solution of alum. When borax is used as a flux, it is customary to add a little nitre or sal ammoniac, to prevent its being made pale by the borax. Juncker reports, that by melting gold with four times its weight of copper, separating the copper by aquafortis unpurified, then melting the gold with the same quantity of fresh copper, and repeating this process eight or nine times, the gold becomes at length of a deep red colour, which sustains the action of lead, antimony, and aquafortis.

§ 2.

Silver.

§. 2. *Silver.*

1131 Ductility of silver. This, next to gold, is the most perfect, fixed, and ductile of all the metals. Its specific gravity is to that of water nearly as 11 to 1. A single grain has been drawn into a wire three yards long, and flatted into a plate an inch broad. In common fire it suffers no diminution of its weight; and, kept in the vehement heat of a glass-house for a month, it loses no more than one sixty-fourth. In the focus of a large burning-glass, it smokes for a long while, then contracts a greyish ash on the surface, and at length is totally dissipated.

Silver is somewhat harder and more sonorous than gold, and is fusible with a less degree of heat. The tenacity of its parts also is nearly one half less than that of gold; a silver wire of $\frac{1}{10}$ of an inch diameter being unable to bear more than 270 pounds.

Mercury unites very readily with silver-leaf, or with the calx of silver precipitated by copper; but does not touch the calces precipitated by alkaline salts.

1132 Effects of sulphur on it: The vapours of sulphureous solutions stain silver yellow or black. Sulphur, melted with silver, debases its colour to a leaden hue, renders it more easily fusible than before, and makes it flow so thin as to be apt in a little time to penetrate the crucible: in a heat just below fusion, a part of the silver shoots up, all over the surface, into capillary efflorescence. Aquafortis does not act upon silver in this compound; but fixed alkaline salts will absorb the sulphur, and from a hepar sulphuris, which, however, is capable of again dissolving the metal. If the sulphurated silver is mixed with mercury sublimate, and exposed to the fire, the mercury of the sublimate will unite with the sulphur, and carry it up in the form of cinnabar, whilst the marine acid of the sublimate unites with the silver into a luna cornea, which remains at the bottom of the glass. Fire alone is sufficient, if continued for some time, to expel the sulphur from silver.

1133 Purification. From the baser metals, silver is purified by cupellation with lead. (See Refining.) It always retains, however, after that operation, some small portion of copper, sufficient to give a blue colour to volatile spirits, which has been erroneously thought to proceed from the silver itself. It is purified from this admixture by melting it twice or thrice with nitre and borax. The scoria, on the first fusion, is commonly blue; on the second, green; and on the third, white, which is a mark of the purification being completed.

1134 Luna cornea reduced. The most effectual means, however, of purifying silver, is by reviving it from luna cornea; because spirit of salt will not precipitate copper as it does silver. The silver may be recovered from luna cornea, by fusion with alkaline and inflammable fluxes; but, in these operations, some loss is always occasioned by the dissipation of part of the volatile calx, before the alkali or metal can absorb its acid.

1135 Mr Margraaf's method. Mr Margraaf has discovered a method of recovering the silver with little or no loss; mercury assisted by volatile salts, imbibing it by trituration without heat. One part of luna cornea, and two of volatile salt, are to be ground together in a glass-mortar, with so much water as will reduce them to the consistence of a thin paste, for a quarter of an hour, or more; five parts of pure quicksilver are then to be added, with a little more water, and the triture to be continued for some hours. A fine amalgam will thus be obtained; which is to be washed with fresh parcels of water, as long as any white powder separates. Nearly the whole of the silver is contained in the amalgam, and may be obtained perfectly pure by distilling off the mercury. The white powder holds a small proportion separable by gentle sublimation; the matter which sublimes is nearly similar to mercurius dulcis.

The colour of silver is debased by all the metals, and its malleability greatly injured by all but gold and copper. The English standard silver contains one part of copper to twelve and one-third of pure silver.

1136 Attraction for lead. This metal discovers in some circumstances a great attraction for lead; though it does not retain any of that metal in cupellation. If a mixture of silver and copper be melted with lead in certain proportions, and the compound afterwards exposed to a moderate fire, the lead and silver will melt out together, bringing very little of the copper with them; by this means silver is often separated from copper in large works. The effect does not wholly depend upon the different fusibility of the metals; for if tin, which is still more fusible than lead, be treated in the same manner with a mixture of silver and copper, the three ingredients are found to attract one another so strongly as to come all into fusion together. Again, if silver be melted with iron, and lead added to the mixture, the silver will forsake the iron to unite with the lead, and the iron will float by itself on the surface.

1137 Whitened externally. Silver is purified and whitened externally by boiling in a solution of tartar and common salt. This is no other than an extraction of the cupreous particles from the surface of the silver, by the acid of the tartar acuated by the common salt.

1138 Fulminating silver. M. Berthollet has lately discovered a method of imparting to the calx of silver a fulminating property, and that much more terrible than fulminating gold itself.

1139 How prepared. His receipt for making it is, "Take cupelled silver, and dissolve it in the nitrous acid; precipitate the silver from the solution by lime-water, decant the clear liquor, and expose the precipitate three days to the open air. Mix this dried precipitate with the caustic volatile alkali, it will turn black; and when dried in the air, after decanting the clear liquor, is the fulminating powder required."

The properties of this powder are said to be so extraordinary, that it is impossible to imagine how any part of it can ever be separated from the rest after it is once prepared.

1140 Fulminates by the touch of any substance whether cold or hot. To make this fulminate, it seems no sensible degree of heat is necessary, the contact of a cold body answering that purpose as well as any other. After it is once made, therefore, it must not be touched, but remain in the vessel in which it is dried; and so violent is the explosion, that it is dangerous to attempt it in larger quantities than a grain at a time.

1141 Dangerous when more than a grain is fulminated at a time. For the same reason it undoubtedly follows, that no more than a grain ought to be made at a time, or at least in one vessel, because no part of it could ever afterwards be separated from the rest. We are told, that, "the wind having turned over a paper containing some atoms of this powder," (we ought to have been

Silver. been informed how the atoms came there, considering what we have just now related,) "the portion touched by the hand fulminated, and of course that which fell upon the ground. A drop of water which fell upon this powder caused it to fulminate. A single grain of fulminating silver, which was in a glass cup, reduced the glass to powder, and pierced several doubles of paper.

1142 Fulminating crystals. "If the volatile alkali, which has been employed with the above powder, be put into a thin glass matrass and boiled, then, on standing in the cold, small crystals will be found sublimed on the interior sides of the vessel, and covering the liquor. On touching one of these crystals the matrass will be burst with considerable explosion.

1143 Cautions to be used in preparing it. "The dangerous properties of this powder suggest the necessity of not preparing it but when the face is covered with a mask with glass eyes; and to avoid the rupture of the glass cups, it is prudent to dry the fulminating silver in small metalline vessels." To this we may add, that as the powder does not fulminate when wet, it may in that state be put up in very small quantities on paper, to be fulminated afterwards as occasion offers. This will perhaps account for the appearance of the few atoms abovementioned on the paper which the wind overturned.

1144 Absurd theory of the antiphlogistons. With regard to the cause of this extraordinary fulmination we can say nothing satisfactory; the following curious reason is assigned by the antiphlogistons; which at once shows the futility of their theory, and sets in a very ridiculous light the hard words with which they would obscure the science of chemistry. "The oxygenous principle * (say they) unites with the hydrogenous principle † of the volatile alkali, and form water in a vaporous state. This water (in a vaporous state) being instantaneously *thrown into a state of vapour*, possessing elasticity and expansive force, is the principal cause of this phenomenon, in which the *azotic* ‡ air which is disengaged from the volatile alkali, with its whole expansile power, has a great share."

* Dephlogisticated air.

† Inflammable air.

‡ Phlogisticated air.

1145 Remarks on this and other theories. On this, as well as other theories, in which elastic fluids are alleged to be the cause of explosions, it is obvious to remark, that should we allow this to be the case, we are utterly at a loss to find a source of heat sufficient to rarefy the vapour to such a degree as is necessary for producing the effect ascribed to it. In the present case, we can scarce suppose a grain weight of metalline calx, already dry, to contain as much either of fire or water as is necessary to produce the effect; nor can we explain why the touch of any cold body, and which may be supposed to contain less fire than the calx itself, should produce such an effect. As to the oxygenous and hydrogenous principles, they were there before the touch, and ought to have produced their effects, not to mention that the water produced
1146 The phenomenon probably owing to electricity. by them could not have amounted to the thousandth part of a grain. It is much more probable, therefore, that the whole is to be considered as an effect of electricity, though we cannot tell how the fluid comes here to be excited in such a violent manner.

## § 3. *Copper*.

This is one of those metals which, from their destructibility by fire, and contracting rust in the air, are called *imperfect*. Of these, however, it is the most perfect and indestructible. It is of a reddish colour when pure; easily tarnishes in a moist air, and contracts a green rust. It is the most sonorous of all the metals, and the hardest and most elastic of all but iron. In some of its states, copper is as difficultly extended under the hammer as iron, but always proves softer to the file; and is never found hard enough to strike a spark with flint or other stones; whence its use for chissels, hammers, hoops, &c. in the gunpowder works. When broke by often bending backwards and forwards, it appears internally of a dull red colour without any brightness, and of a fine granulated texture resembling some kinds of earthen ware. It is considerably ductile, though less so than either gold or silver; and may be drawn into wire as fine as hair, or beaten into leaves almost as thin as those of silver. The tenacity of its parts is very considerable; for a copper wire of $\frac{1}{10}$ of an inch diameter will support a weight of $299\frac{1}{4}$ pounds without breaking. The specific gravity of this metal, according to Dr Lewis, is to that of water as 8.830 to 1. Copper. 1147 Always softer than iron.

Copper continues malleable when heated red; in which respect it agrees with iron; but is not, like iron, capable of being welded, or having two pieces joined into one. It requires for its fusion a stronger heat than either gold or silver, though less than that requisite to melt iron. When in fusion, it is remarkably impatient of moisture; the contact of a little water occasioning the melted copper to be thrown about with violence, to the great danger of the by-standers. It is, nevertheless, said to be granulated in the brass-works at Bristol, without explosion or danger, by letting it fall in little drops, into a large cistern of cold water covered with a brass-plate. In the middle of the plate is an aperture, in which is secured with Sturbridge clay a small vessel, whose capacity is not above a spoonful, perforated with a number of minute holes, through which the melted copper passes. A stream of cold water passes through the cistern. If suffered to grow hot, the copper falls liquid to the bottom, and runs into plates. 1148 How granulated.

Copper, in fusion, appears of a bluish green colour, nearly like that of melted gold. Kept in fusion for a long time, it becomes gradually more and more brittle; but does not scorify considerably, nor lose much of its weight. It is much less destructible than any of the imperfect metals, being very difficultly subdued even by lead or bismuth. If kept in a heat below fusion, it contracts on the surface thin powdery scales; which, being rubbed off, are succeeded by others, till the whole quantity of the metal is thus changed into a scoria or calx, of a dark reddish colour. This calx does not melt in the strongest furnace fires; but, in the focus of a large burning mirror, runs easily into a deep red, and almost opaque, glass. A flaming fire, and strong draught of air over the surface of the metal, greatly promote its calcination. The flame being tinged of a green, bluish, or rainbow colour, is a mark that the copper burns. 1149 Calcined.

This metal is very readily soluble by almost all saline substances; even common water, suffered to stand long in copper-vessels, extracts so much as to gain a coppery taste. It is observable, that water is much more impregnated with this taste, on being suffered to stand in the cold, than if boiled for a longer time in the vessel. The same thing happens in regard to the mild vegetable acids. The confectioners prepare the most acid syrups, even those of lemons and oranges, by 1150 Solubility.

Copper. by boiling in clean copper-vessels, without the preparations receiving any ill taste from the metal; whereas, either the juices themselves, or the syrups made from them, if kept cold in copper vessels, soon become impregnated with a disagreeable taste, and with the pernicious qualities of the copper.

1151 Altered by combination with vegetable acids. By combination with vegetable acids, copper becomes in some respects remarkably altered. Verdigris, which is a combination of copper with a kind of acetous or tartareous acid, is partially soluble in distilled vinegar; the residuum, on being melted with borax and linseed oil, yields a brittle metallic substance, of a whitish colour, not unlike bell-metal. The copper also, when revived from the distilled verdigris, was found by Dr Lewis to be different from the metal before dissolution; but neither of these changes have yet been sufficiently examined.

1152 Amalgamation with mercury. Copper, in its metallic state, is very difficultly amalgamated with mercury; but unites with it more easily if divided by certain admixtures. If mercury and verdigris be triturated together with common salt, vinegar, and water, the copper in the verdigris will be imbibed by the mercury, and form with it, as Boyle observes, a curious amalgam, at first so soft as to receive any impression, and which, on standing, becomes hard like brittle metals. Brass leaf likewise gives out its copper to mercury, the other ingredient of the brass separating in the form of powder.

1153 Dr Lewis's method. Easier methods of amalgamating copper are published by Dr Lewis in his notes on Wilson's Chemistry, p. 432. His receipts are,—"Dissolve some fine copper in aquafortis: when the menstruum will take up no more of the metal, pour it into an iron mortar, and add six times the weight of the copper, of mercury, and a little common salt: grind the whole well together with an iron pestle; and, in a little time, the copper will be imbibed by the mercury, and an amalgam formed, which may be rendered bright by washing it well with repeated affusions of water.

"*Another method.* Take the muddy substance which is procured in the polishing of copper plates with a pumice stone, and grind it well with a suitable portion of mercury, a little common salt, and some vinegar, in an iron mortar, (a marble one will do, if you make use of an iron pestle), till you perceive the mercury has taken up the copper." The copper recovered from these amalgams retains its original colour, without any tendency to yellow. Even when brass is made use of for making the amalgam, the recovered metal is perfect red copper; the ingredient from which the brass received its yellowness being, as above observed, separated in the amalgamation.

1154 Brass, how prepared. Copper is the basis of several metals for mechanic uses; as brass, prince's metal, bell-metal, bath-metal, white copper, *&c.* Brass is prepared from copper and calamine, with the addition of powdered charcoal, cemented together, and at last brought into fusion. The calamine is to be previously prepared by cleansing it from adhering earth, stone, or other matters; by roasting, or calcining it; and by grinding it into a fine powder. The length of time, and degree of heat, requisite for the calcination of the calamine, are different according to the qualities of that mineral. The calamine, thus calcined, cleansed, and ground, is to be mixed with about a third or fourth part of charcoal dust, or powdered pit-coal, as is done in some parts of England. The malleability of the basis is diminished by the use of pit-coal, which is therefore only employed for the preparation of the coarser kinds. To this composition of calamine and coal, some manufacturers add common salt, by which the process of making brass is said to be hastened. In Goslar, where the cadmia adhering to the insides of the furnaces is used instead of the native calamine, a small quantity of alum is added, by which they pretend the colour of the brass is heightened. With this composition, and with thin plates or grains of copper, the crucibles are to be nearly filled. The proportion of the calamine to the copper varies according to the richness of the former, but is generally as three to two. The copper must be dispersed through the composition of calamine and coal; and the whole must be covered with more coal, till the crucibles are full. The crucibles, thus filled, are to be placed in a furnace sunk in the ground, the form of which is that of the frustum of a hollow cone. At the bottom of the furnace, or greater basis of the frustum, is a circular grate, or iron-plate. This plate is covered with a coat of clay and horse-dung, to defend it from the action of the fire; and pierced with holes, through which the air maintaining the fire passes. The crucibles stand upon the circular plate, forming a circular row, with one in the middle. The fuel is placed betwixt the crucibles, and is thrown into the furnace at the upper part of it, or the lesser basis of the frustum. To this upper part or mouth of the furnace is fitted a cover made of bricks or clay, kept together with bars of iron, and pierced with holes. This cover serves as a register. When the heat is to be increased, the cover must be partly or entirely taken off, and a free draught is permitted to the external air, which passes along a vault under-ground to the ash-hole, through the holes in the circular grate or plate, betwixt the crucibles, and through the upper mouth, along with the smoke and flame, into an area where the workmen stand, which is covered with a large dome or chimney, through which the smoke and air ascend. When the heat is to be diminished, the mouth of the furnace is closed with the lid; through the holes of which the air, smoke, and flame pass. The crucibles are to be kept red-hot during eight or ten hours; and in some places much longer, even several days, according to the nature of the calamine. During this time, the zinc rises in vapour from the calamine, unites with the copper, and renders that metal considerably more fusible than it is by itself. To render the metal very fluid, that it may flow into one uniform mass at the bottom, the fire is to be increased a little before the crucibles are taken out, for pouring off the fluid metal into moulds. From 60 pounds of good calamine, and 40 of copper, 60 pounds of brass may be obtained, notwithstanding a considerable quantity of the zinc is dissipated in the operation. The quantity of brass obtained has been considerably augmented since the introduction of the method now commonly practised, of granulating the copper; by which means a larger surface of this metal is exposed to the vapour of zinc, and consequently less of that vapour escapes. To make the finer and more malleable kinds of brass, besides the choice of pure calamine and pure copper,

Copper. some manufacturers cement the brass a second time with calamine and charcoal; and sometimes add to it old brass, by which the new is said to be meliorated.

Brass is brittle when hot; but so ductile when cold, that it may be drawn into very fine wire, and beat into very thin leaves. Its beautiful colour, malleability, and its fusibility, by which it may be easily cast into moulds, together with its being less liable to rust than copper, render it fit for the fabrication of many utensils.

Although zinc be fixed to a certain degree in brass, by the adhesion which it contracts with the copper; yet when brass is melted, and exposed to a violent fire, during a certain time, the zinc dissipates in vapours, and even flames away, if the heat be strong enough; and if the fire is long enough continued, all the zinc will be evaporated and destroyed, so that what remains is copper.

2d 1154 Princes metal. Prince's metal is made by melting zinc in substance with copper; and all the yellow compound metals prepared in imitation of gold are no other than mixtures of copper with different proportions of that semimetal, taken either in its pure state, or in its natural ore calamine, with an addition sometimes of iron-filings, *&c.* Zinc itself unites most easily with the copper; but calamine makes the most ductile compound, and gives the most yellow colour. Dr Lewis observes, that a little of the calamine renders the copper pale; that when it has imbibed about $\frac{1}{12}$ its own weight, the colour inclines to yellow; that the yellowness increases more and more, till the proportion comes to almost one half; that on further augmenting the calamine, the compound becomes paler and paler, and at last white. The crucibles, in which the fusion is performed in large works, are commonly tinged by the matter of a deep blue colour.

1155 Bell-metal. Bell-metal is a mixture of copper and tin; and tho' both these metals singly are malleable, the compound proves extremely brittle. Copper is dissolved by melted tin easily and intimately, far more so than by lead. A small portion of tin renders this metal dull-coloured, hard, and brittle. Bell-metal is composed of about ten parts of copper to one of tin, with the addition commonly of a little brass or zinc. A small proportion of copper, on the other hand, improves the colour and consistency of tin, without much injuring its ductility. Pewter is sometimes made from one part of copper and twenty or more of tin.

1156 Dr Lewis's observations on the specific gravity of the metal. It has long been observed, that though tin is specifically much lighter than copper, yet the gravity of the compound, bell-metal, is greater than that of the copper itself. The same augmentation of gravity also takes place where the lighter metal is in the greatest proportion; a mixture even of one part of tin with two of copper, turning out specifically heavier than pure copper. Most metallic mixtures answer to the mean gravity of the ingredients, or such as would result from a bare apposition of parts. Of those tried by Dr Lewis, some exceeded the mean, but the greater number fell short of it; tin and copper were the only ones that formed a compound heavier than the heaviest of the metals separately.

1157 White copper. White copper is prepared by mixing together equal parts of arsenic and nitre, injecting the mixture into a red-hot crucible, which is to be kept in a moderate fire till they subside, and flow like wax. One part of this mixture is injected upon four parts of melted copper, and the metal, as soon as they appear thoroughly united together, immediately poured out. The copper, thus whitened, is commonly melted with a considerable proportion of silver, by which its colour is both improved and rendered more permanent. The white copper of China and Japan appears to be no other than a mixture of copper and arsenic. Geoffroy relates, that, on repeated fusions, it exhaled arsenical fumes, and became red copper, losing with its whiteness, one seventh of its weight.

### § 4. *Iron.*

Iron.

Iron is a metal of a greyish colour; soon tarnishing in the air into a dusky blackish hue; and in a short time contracting a yellowish, or reddish rust. It is the hardest of all metals: the most elastic; and, excepting platina, the most difficult to be fused. Next to gold, iron has the greatest tenacity of parts; an iron wire, the diameter of which is the tenth part of an inch, being capable of sustaining 450 pounds. Next to tin, it is the lightest of all the metals, losing between a seventh and eighth part of its weight when immersed in water. When very pure, it may be drawn into wire as fine as horse-hair; but is much less capable of being beaten into thin leaves than the other metals, excepting only lead. 1158 Tenacity of its parts.

Iron grows red-hot much sooner than any other metal; and this, not only from the application of actual fire, but likewise from strong hammering, friction, or other mechanic violence. It nevertheless melts the most difficultly of all metals except manganese and platina; requiring, in its most fusible state, an intense, bright, white heat. When perfectly malleable, it is not fusible at all by the heat of furnaces, without the addition or the immediate contact of burning fuel; and, when melted, loses its malleability: all the common operations which communicate one of these qualities deprive it at the same time of the other; as if fusibility and malleability were in this metal incompatible. When exposed to the focus of a large burning mirror, however, it quickly fused, boiled, and emitted an ardent fume, the lower part of which was a true flame. At length it was changed into a blackish vitrified scoria.

From the great waste occasioned by exposing iron to a red but especially to a white heat, this metal appears to be a combustible substance. This combustion is maintained, like that of all other combustible substances, by contact of air. Dr Hook, having heated a bar of iron to that degree called *white heat*, he placed it upon an anvil, and blowed air upon it by means of bellows, by which it burnt brighter and hotter. Exposed to a white heat, it contracts a semivitreous coat, which bursts at times, and flies off in sparkles. No other metallic body exhibits any such appearance. On continuing the fire, it changes by degrees into a dark red calx, which does not melt in the most vehement heat procurable by furnaces, and, if brought into fusion by additions, yields an opaque black glass. When strongly heated, it appears covered on the surface with a soft vitreous matter like varnish. In this state, pieces of it cohere; and, on 1159 Iron a combustible substance.

being

Iron.

being hammered together, weld or unite, without discovering a juncture. As iron is the only metal which exhibits this appearance in the fire, so it is the only one capable of being welded. Those operations which prevent the superficial scorification, deprive it likewise of this valuable property: which may be restored again, by suffering the iron to resume its vitreous aspect; and, in some measure, by the interposition of foreign vitrescible matters; whilst none of the other metals will unite in the smallest degree, even with its own scoria.

1160 The only metal capable of being welded.

1161 Contracts in fusion.

Iron expands the least of all metals by heat. In the act of fusion, instead of continuing to expand, like the other metals, it shrinks; and thus becomes so much more dense, as to throw up such part as is unmelted to the surface; whilst pieces of gold, silver, copper, lead, or tin, put into the respective metals in fusion, sink freely to the bottom. In its return to a consistent state, instead of shrinking like the other metals, it expands; sensibly rising in the vessel, and assuming a convex surface, while the others become concave. This property, first observed by Raumur, excellently fits it for receiving impressions from moulds. By the increase of bulk which the metal receives in congelation, it is forced into the minutest cavities, so as to take the impression far more exactly than the other metals which shrink.

1162 Dissolved by all metals except lead and mercury.

Iron is dissolved by all the metals made fluid, except lead; though none of them act so powerfully upon it as gold: but, as Cramer observes, if the iron contains any portion of sulphur, it can scarcely be made to unite at all with gold.

Among the semimetallic bodies, it is averse to an union with mercury; no method of amalgamating these two having yet been discovered; though quicksilver, in certain circumstances, seems in some small degree to act upon it. A plate of tough iron, kept immersed in mercury for some days, becomes brittle; and mercury will often adhere to and coat the ends of iron pestles used in triturating certain amalgams with saline liquors. Mr Jones has also discovered, that by plunging iron, while heated to an intense white heat, into mercury, the latter will adhere to the surface of the iron, and completely silver it over.

Next to mercury, zinc is the most difficultly combined with iron; not from any natural indisposition to unite, but from the zinc being difficultly made to sustain the heat requisite. The mixture is hard, somewhat malleable, of a white colour approaching to that of silver. Regulus of antimony, as soon as it melts, begins to act on iron, and dissolves a considerable quantity. If the regulus be stirred with a iron rod, it will melt off a part of it. Arsenic likewise easily mingles with iron, and has a strong attraction for it; forsaking all the other metals to unite with this. It renders the iron white, very hard, and brittle.

1163 Prussian blue.

This metal is the basis of the fine blue pigment, called, from the place where it was first discovered, *Berlin* or *Prussian* blue. This colour was accidentally discovered about the beginning of the present century, by a chemist of Berlin, who, having successively thrown upon the ground several liquors from his laboratory, was much surprised to see it suddently stained with a beautiful blue colour. Recollecting what liquors he had thrown out, and observing the same effects from a similar mixture, he prepared the blue for the use of painters; who found that it might be substituted to ultramarine, and accordingly have used it ever since.

1164 Dr Woolward's recept for.

Several chemists immediately endeavoured to discover the composition of this pigment; and in the year 1724 Dr Woodward published the following process, in the Philosophical Transactions, for making it. "Alkalize together four ounces of nitre, and as much tartar as is directed for charcoal (n° 779). Mix this alkali well with four ounces of dried bullocks blood; and put the whole in a crucible covered with a lid, in which there is a small hole. Calcine with a moderate heat, till the blood be reduced to a perfect coal; that is, till it emits no more smoke or flame capable of blackening any white bodies that are exposed to it. Increase the fire towards the end, so that the whole matter contained in the crucible shall be moderately, but sensibly, red.

"Throw into two pints of water the matter contained in the crucible, while yet red, and gave it half an hour's boiling: decant this first water; and pour more upon the black charry coal, till it becomes almost insipid. Mix together all these waters; and reduce them, by boiling, to about two pints.

"Dissolve also two ounces of martial vitriol, and eight ounces of alum, in two pints of boiling water. Mix this solution when hot with the preceding lixivium also hot. A great effervescence will then be made: the liquors will be rendered turbid; and will become of a green colour, more or less blue; and a precipitate will be formed of the same colour. Filtrate, in order to separate this precipitate; upon which pour spirit of salt, and mix them well together; by which means the precipitate will become of a fine blue colour. It is necessary to add rather too much of the salt than too little, and till it no longer increases the beauty of the precipitate. The next day wash this blue, till the water comes off from it insipid; and then gently dry it."

1165 Mr Geoffroy's theory.

Mr Geoffroy was the first who gave any plausible theory of this process, or any rational means of improving it. He observes, that the Prussian blue is no other than the iron of the vitriol revived by the inflammable matter of the alkaline lixivium, and perhaps a little brightened by the earth of alum; that the green colour proceeds from a part of the yellow ferruginous clax, or ochre, unrevived, mixing with the blue; and that the spirit of salt dissolves this ochre more readily than the blue part; though it will dissolve that also by long standing, or if used in too large quantity. From these principles, he was led to increase the quantity of inflammable matter; that there might be enough to revive the whole of the ferruginous ochre, and produce a blue colour at once, without the use of the acid spirit. In this he perfectly succeeded; and found, at the same time, that the colour might be rendered of any degree of deepness, or lightness, at pleasure. If the alkali is calcined with twice its weight of dried blood, and the lixivium obtained from it poured into a solution of one part of vitriol to six of alum, the liquor acquires a very pale blue colour, and deposits as pale a precipitate. On adding more and more of a fresh solution of vitriol, the colour becomes deeper and deeper, almost to blackness. He imagines, with great probability, that the blue pigment, thus prepared, will prove more durable in the air, mingle more perfectly with other colours, and be less

Iron

less apt to injure the lustre of such as are mixed with or applied in its neighbourhood, than that made in the common manner; the tarnish to which common Prussian blue is subject, seeming to proceed from the acid, which cannot be separated by any ablution.

1166 Amusing phenomenon in the preparation.

He takes notice of an amusing phenomenon which happens upon mixture. When the liquors are well stirred together; and the circular motion, as soon as possible, stopped; some drops of solution of vitriol, (depurated, by long settling), let fall on different parts of the surface, divide, spread, and form curious representations of flowers, trees, shrubs, flying insects, &c. in great regularity and perfection. These continue 10 or 12 minutes: and on stirring the liquor again, and dropping in some more of the solution of vitriol, are succeeded by a new picture.

1167 Mr Macquer's theory.

This theory is confirmed by Mr Macquer, in a Memoir printed in the year 1752. He observes, that the quantity of phlogiston communicated to the iron in this process is so great, as not only to cause the metal resist in a great measure the action of acids, and become totally unaffected by the magnet; but by a slight calcination it becomes entirely similar to other iron, and is at once deprived of its blue colour. He further observes, that fire is not the only means by which Prussian blue may be deprived of all the properties which distinguish it from ordinary iron. A very pure alkali produces the same effect. He has also discovered, that the alkali which has thus deprived the Prussian blue of all the properties which distinguish it from ordinary iron, becomes, by that operation, entirely similar to the phlogisticated alkali used for the preparation of Prussian blue.

By a more particular examination, he found, that the alkali might become perfectly saturated with the colouring matter; so that, when boiled on Prussian blue, it extracted none of its colour. When the salt was thus perfectly saturated, it seemed no longer to possess any alkaline qualities. If poured into a solution of iron in any acid, a single, homogeneous, and perfect precipitate, was formed; not green, as in Dr Woodward's process, but a perfect Prussian blue; which needed no acid to brighten its colour. A pure acid added to the alkali was not in the least neutralized, nor in the least precipitated the colouring matter. From hence Mr Macquer concludes, that, in the making of Prussian blue, vitriol is decomposed; because the iron has a strong attraction for the colouring matter, as well as the acid for the alkali; and the sum of the attraction of the acid to the alkali, joined to that of the iron for the colouring matter, is greater than the single attraction of the acid to the metal.

1168 Phlogisticated alkali loses its alkaline properties.

1169 Earths do not attract the colouring matter.

Another very important phenomenon is, that earths have not the same attraction for this colouring matter that metallic substances have. Hence, if an alkali saturated with this colouring matter be poured into a solution of alum, no decomposition is effected, nor any precipitate formed. The alum continues alum, and the alkali remains unchanged. From this experiment Mr Macquer concludes that alum does not directly contribute to the formation of the Prussian blue. The purpose he thinks it answers is as follows. Fixed alkaline salts can never be perfectly saturated with phlogistic matter by calcination; alkalies, therefore, though calcined with inflammable substances, so as to make a proper lixivium for Prussian blue, remain still alkaline. Hence, when mixed with a solution of green vitriol, they form, by their purely alkaline part, a yellow precipitate, so much more copious, as the alkali is less saturated with phlogiston. But nothing is more capable of spoiling the fine colour of the Prussian blue, than an admixture of this yellow precipitate: it is therefore necessary to add a quantity of alum, which will take up the greatest part of the purely alkaline salt, and of consequence the quantity of yellow ferruginous precipitate is much diminished. But the earth of alum, being of a fine shining white, does not in the least alter the purity of the blue colour, but is rather necessary to dilute it. From all this it follows, that it is a matter of indifference whether the green precipitate is to be again dissolved by an acid, or the alkaline part of the lixivium saturated with alum or with an acid, before the precipitate is formed. The latter indeed seems to be the most eligible method.

Iron.

1170 Blue producible from other alkalies.

Most alkalies obtained from the ashes of vegetables, being combined, by their combustion, with a portion of inflammable matter, are capable of furnishing a quantity of Prussian blue, proportionable to the quantity of colouring matter they contain, even without the necessity of mixing them with a solution of iron; because they always contain a little of this metal dissolved, some of which may be found in almost all vegetables; therefore it is sufficient to saturate them with an acid. Henckel observed the production of this blue in the saturation of the fossile alkali, and recommended to chemists to inquire into its nature.

1171 Mr Scheele discovers the colouring matter of Prussian blue.

The theories of Geoffroy, Macquer, &c. however, with respect to Prussian blue, have now given place to that of Mr Scheele; who has examined the substance with the utmost care, and found the colouring matter to consist of an extremely volatile substance, capable of uniting with and neutralizing alkalies, but easily expelled from them by any other acid, even by that of fixed air. He begins his dissertation on this subject by observing, that the solution of alkali calcined with dried blood, which he calls *lixivium sanguinis*, by exposure to the air, loses its property of precipitating the iron of a blue colour; and that the precipitate thus obtained is entirely soluble in the acid. In order to determine whether the air had thus undergone any change, he put some newly prepared lixivium into a glass vessel well sealed with rosin; but after some time finding no change on the lixivium, or on the air contained in the vessel, he began to think that this might be occasioned by the absence of fixed air, which always abounds in the open atmosphere, though not in any confined portion of it, at least in an equal proportion. Having therefore filled a glass vessel with fixed air, he poured into it a little lixivium sanguinis; and next day found, that it threw down from green vitriol a precipitate entirely soluble in acids. With other acids he obtained no precipitate.

1172 Lixivium sanguinis loses its colouring property by exposure to the air.

1173 Supposed to arise from the fixed air absorbed from the atmosphere.

1174 The matter fixed by the addition of some green vitriol to the lixivium.

On inverting the experiment, and mixing some green vitriol with lixivium sanguinis, the mixture grew yellow; and he found this addition capable of fixing the colouring matter so that neither the acid of fixed air nor any other could expel it from the alkali. For having poured the mixture abovementioned into a solution of green vitriol, and afterwards supersaturated the

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the lixivium with acid, he obtained a conſiderable quantity of blue. To the ſame lixivium ſanguinis, in which a ſmall quantity of green vitriol was diſſolved, he afterwards added of the other acids ſomewhat more than was neceſſary for its ſaturation; and though this was done, a conſiderable quantity of Pruſſian blue was af-

1175 Calx of iron ſoluble in lixivium ſanguinis;

terwards obtained. Again, having precipitated a ſolution of green vitriol with alkali, and boiled the precipitate for ſome minutes in lixivium ſanguinis, part of it was diſſolved: the filtered lixivium underwent no change when expoſed to the open air or to the aerial acid, and precipitated the ſolution of vitriol of a blue; and though the lixivium was ſuperſaturated with acid, and ſome green vitriol added, a very beautiful Pruſſian

1176 But not when highly dephlogiſticated.

blue was obtained. This, however, will not hold when a perfectly dephlogiſticated calx of iron is employed, of which none can be diſſolved by the lixivium ſanguinis; nor will any Pruſſian blue be obtained by precipitating with lixivium ſanguinis a perfectly dephlogiſticated ſolution of iron in nitrous acid.

1177 The colouring matter taken up by the air after it has been expelled by acids.

To determine what had become of the colouring matter in thoſe experiments where it ſeemed to have been diſſipated, ſome lixivium ſanguinis was poured into a veſſel filled with aerial acid. It was kept well corked during the night, and next day a piece of paper dipped in a ſolution of green vitriol was fixed to the cork, pencilling it over with two drops of a ſolution of alkali in water. The paper was thus ſoon covered with precipitated iron; and on being taken out two hours afterwards, and dipped in muriatic acid, became covered with moſt beautiful Pruſſian blue. The ſame thing happened when lixivium ſanguinis ſuperſaturated with vitriolic acid was employed; for in this caſe alſo the air was filled with the colouring matter capable of being in like manner abſorbed by the calx of iron. But though from theſe experiments it is plain that acids expel this colouring ſubſtance from the lixivium, a given quantity of air is only capable of receiving a certain quantity of it; for the ſame mixture removed into another veſſel imparts the colouring property to the air it contains according to its quantity. On putting perfectly dephlogiſticated calx of iron upon the papers, no Pruſſian blue was formed; but the muriatic acid diſſolved the calx entirely.

1178 The colouring matter expelled by diſtillation with vitriolic acid.

Our author having now aſſured himſelf that acids really attract the alkali more than the colouring matter, proceeded to try the effects of diſtillation. Having therefore ſuperſaturated ſome lixivium ſanguinis with vitriolic acid, he diſtilled the mixture in a glaſs retort with a gentle fire. When about one-third had paſſed over, he changed the receiver, and continued the operation till one-half was diſtilled. The firſt product had a peculiar taſte and ſmell; the air in the receiver was filled with colouring matter, and the aqueous fluid was alſo ſtrongly impregnated with it, as appeared by its forming a fine Pruſſian blue with phlogiſticated calx of iron. Part of it being expoſed to the open air for ſome hours, entirely loſt its power, and the product of the ſecond operation was no other than water mixed with a little vitriolic acid.

1179 Attemps to procure the colouring matter by itſelf.

The next ſtep was to procure, if poſſible, the colouring matter by itſelf; and this he attempted to obtain from the Pruſſian blue, rather than the lixivium ſanguinis, as he would thus not only avoid the troubleſome calcination of the alkali and blood, but obtain the colouring matter im much larger quantity than could be done from the lixivium. On examining ſeveral kinds of this pigment, he found in them evident marks of ſulphur, volatile alkali, vitriolic acid, and volatile ſulphureous acid; all of which ſubſtances are to be found in the lixivium ſanguinis as well as in that of ſoot, and adhere to the precipitate in the preparation of Pruſſian blue. Finding, however, that he could not obtain his purpoſe by any kind of analyſis of theſe by fire alone, he had recourſe to a neutral ſalt uſed by 1180

Neutral ſalt for diſcovering iron in mineral waters.

chemiſts for diſcovering iron in mineral waters. This is formed by digeſting cauſtic fixed alkali on Pruſſian blue, which effectually extracts the colour from it even in the cold, in a very ſhort time, and being neutralized, may eaſily be reduced into a dry form. But it is not entirely to be depended upon for this purpoſe; for it always contains ſome iron which indeed is the medium of its connection with the alkali. The lixivium ſanguinis is preferable, though even this contains ſome iron, as well as the lixivium of ſoot; our author's experiments, however, were made with the neutral ſalt, for the reaſon already mentioned. 1181

Effects of diſtilling this ſalt with oil of vitriol.

1 An ounce of the ſalt was diſſolved in a glaſs retort in four ounces of water, afterwards adding three drachms of concentrated vitriolic acid; and the mixture was diſtilled with a gentle fire. The maſs grew thick as ſoon as it began to boil; from a great quantity of Pruſſian blue, a quantity of the colouring matter appeared by the ſmell to penetrate the lute: and part of it was abſorbed by the air in the receiver, as in former experiments. The diſtillation was continued till about an ounce had paſſed into the receiver. The blue maſs remaining in the retort was put into a ſtrainer, and a piece of green vitriol put into the liquid which paſſed through; but by this laſt no Pruſſian blue was produced. The blue which remained in the filter was again treated with lixivium tartari: the ſolution freed from its ochre by filtration, and the clear liquor committed a ſecond time to diſtillation with vitriolic acid. Pruſſian blue was again ſeparated, though in ſmaller quantity than before, and the colouring matter came over into the receiver. After one third of the matter had paſſed over, that which had been obtained by the firſt diſtillation was added to it, the Pruſſian blue was ſeparated from the lixivium in the retort, and extracted a third time. Some Pruſſian blue was formed again, though in much ſmaller quantity; whence it is apparent that Pruſſian blue may at laſt be totally decompoſed by means of alkali. Lime, or terra ponderoſa, likewiſe extract the blue colour, and ſhow the ſame phenomena as alkali.

With volatile alkali a compound, conſiſting of the alkali, iron, and colouring matter, is formed, which ſhows the ſame phenomena with that formed with fixed alkali. By diſtillation *per ſe* after it has been diſſolved in water, the liquor grows thick in conſequence of a ſeparation of Pruſſian blue, and volatile alkali paſſes over into the receiver. This volatile ſpirit is impregnated with the colouring matter; it is not precipitated by lime water; but green vitriol is precipitated by it; and on adding an acid, Pruſſian blue is formed. If a piece of paper, dipped in a ſolution of green vitriol, be expoſed to the vapour of this alkali, it is ſoon decompoſed; and if the ſame be pencilled over with muriatic acid, it inſtantly becomes blue.

1182 Colouring matter unites with volatile alkali.

blue.

Iron.

blue. On exposing the liquor to the open air, it all evaporates, leaving pure water behind.

1183 How to free the colouring matter perfectly from its vitriolic taint.

As in all the operations with vitriolic acid hitherto related, some small quantity of it passes into the receiver, our author shows how to deprive the colouring matter, of that vitriolic taint. For this purpose nothing more is necessary than to put a little chalk into the matter, and redistil it with a very gentle heat; the acid unites with the chalk, and the colouring matter goes over in its greatest purity.

1184 How to prevent the escape of the colouring matter thro' the lute.

In order to hinder, as much as possible, the escape of the volatile colouring matter through the lute, he makes use of a small receiver, putting into it a little distilled water, and placing it so that the greater part shall be immersed in cold water during the operation. The water impregnated with this colouring matter has a peculiar but not disagreeable smell, a taste somewhat approaching to sweet, and warm in the mouth, at the same time exciting cough.

1185 This matter neither acid nor alkaline.

When rectified as above directed, it appears to be neither acid nor alkaline; for it neither reddens paper dyed with lacmus, nor does it restore the colour of such paper after it has been made red; but it renders turbid the solutions of soap and hepar sulphuris. The same liquor mixed with fixed alkali, though it contains a superabundance of colouring matter, restores the blue colour of paper reddened by an acid. By distillation to dryness, there goes over a part of the colouring matter which disengages itself from the alkali; the residuum is soluble in water, and has all the properties of the best lixivium sanguinis; but, like the true lixivium, it is decomposed by all the acids, even by that of fixed air.

1186 Forms a kind of ammoniacal salt with volatile alkali.

With caustic volatile alkali it forms a kind of ammoniacal salt; which, however, always smells volatile, though the colouring matter be in ever so great proportion. By distillation the whole instantly rises, and nothing but pure water is left in the retort.

1187 Dissolves magnesia alba.

Magnesia precipitated from Epsom salt by caustic volatile alkali, was dissolved in the colouring matter by allowing them to stand together for several days in a warm close bottle. On exposure to the open air, the magnesia separated from it by its superior attraction for aerial acid, and formed on the surface of the water a pellicle like that of cream of tartar. This solution was likewise decomposed by alkalies and lime-water.

1188 Very little terra ponderosa.

The colouring matter dissolves but a very small quantity of terra ponderosa, which may be afterwards precipitated by vitriolic and even by aerial acid.

1189 Dissolves lime, but no clay.

Pure clay, or the basis of alum, is not attacked by it. Lime is dissolved in a certain quantity. The superabundant portion should be separated by filtration; and as the liquor contains, besides the combined lime, the portion which water itself is able to take up, in order to free it from this, precisely the same quantity of water impregnated with aerial acid is to be added as is requisite for precipitating an equal quantity of lime-water. The colouring matter, thus saturated with lime, is to be filtered again, and then to be preserved in a well closed bottle to prevent the access of fixed air. This solution is decomposed by all the acids, and by the pure or caustic alkalies. By distillation the colouring matter rises, and nothing but pure lime is left in the retort.—This solution of lime appears to our author to be so perfectly saturated, that he employed it in preference to any other in the experiments he made on metals, and which we are now about to relate.

1190 The solution of lime the most proper for experiments on metals.

Iron.

1191 Silver, quickfilver, and iron precipitated by the colouring matter.

From the trials made by Mr Scheele, it appears that the colouring matter has no effect upon any metal or metallic solution, excepting those of silver and quicksilver in nitrous acid, and that of iron in fixed air. The first is precipitated in a white powder: the second in a black one; and the third assumes a sea-green colour, which afterwards turns to blue.

1192 Its effects on metallic calces;

With metallic calces it produces the following phenomena. 1. Gold precipitated by aerated alkali becomes white. 2. The fixed air is disengaged from a precipitate of silver with a slight effervescence. 3. Calx of mercury is dissolved, and yields crystals by gentle evaporation. 4. The calx of copper precipitated by aerated alkali effervesces, and assumes a faint citron colour. 5. Calx of iron precipitated from its solution in the vitriolic acid by the same alkali, effervesces, and assumes a dark blue colour. 6. Precipitated cobalt shows some signs of effervescence, and changes into a yellowish brown colour. The other calces are not acted upon.

1193 On metallic solutions.

The precipitating liquor abovementioned, poured into metallic solutions, produces the following appearances by means of double elective attraction. 1. Gold is precipitated of a white colour, but by adding a superabundant quantity of the precipitating liquor the calx is redissolved. The second solution is colourless as water. 2. Silver is precipitated in form of a white substance of the consistence of cheese; by adding more of the liquor the precipitate is redissolved, and the solution is not decomposed either by sal-ammoniac or marine acid. 3. Corrosive sublimate apparently undergoes no change, though it is in reality decompounded; the calx being dissolved in the colouring matter. Mercury dissolved in the nitrous acid without heat, is precipitated in form of a black powder. 4. The solutions of tin and bismuth are precipitated, but the calx is not acted upon by the colouring matter. 5. The same effects are produced on the solution of butter of antimony, as well as on that of well dephlogisticated calx of iron. 6. Blue vitriol is precipitated of a yellow citron colour: if more of the precipitating liquor be added, the precipitate is redissolved into a colourless liquor and a colourless solution of the same calx is likewise obtained by volatile alkali. On adding more of the solution of blue vitriol, the solution likewise disappears, and the liquor assumes a green colour. Acids dissolve a portion of this precipitate, and the remainder is white. The muriatic acid dissolves the precipitate completely, but lets it fall again on the addition of water. 7. The solution of white vitriol yields a white precipitate, which is not redissolved by addition of the precipitating liquor, but is soluble in acids. These solutions smell like the colouring matter, which may be separated from them by distillation. 8. Green vitriol is precipitated first of a yellowish brown colour, which soon changes to green, and then becomes blue on the surface. Some hours afterwards the precipitate subsides to the bottom of the vessels, and then the whole mixture turns blue; but on adding any acid the precipitate becomes instantly blue. If a very small quantity of green vitriol be put into the precipitating liquor, the

Iron.

the precipitate is entirely diſſolved, and the whole aſſumes a yellow colour. 7. Solution of cobalt lets fall a browniſh yellow precipitate, which is not diſſolved by adding more of the precipitating liquor, neither is it ſoluble in acids. By diſtillation the colouring matter goes over into the receiver.

1194 Inveſtigation of the conſtituent part of the colouring matter.

Laſtly, our author undertook an inveſtigation of the conſtituent parts of the colouring matter itſelf; and in this he ſucceeded in ſuch a manner as muſt do honour to his memory, at the ſame time that it promiſes to be a real and laſting improvement to ſcience, by ſhowing a method of preparing this valuable pigment without that nauſeous and horrid ingredient, blood, which

1195 Inflammability of the colouring matter.

is now uſed in great quantities for that purpoſe.—His firſt hint concerning this matter ſeems to have been taken from an obſervation of the air in his receiver accidentally taking fire from the neighbourhood of a candle. It burned without any exploſion, and he was able to inflame it ſeveral times ſucceſſively. Wiſhing to know whether any fixed air was contained in the colouring matter, he filled a retort half full of the liquor containing the colouring matter, and applying a receiver immediately after, gave the retort a briſk heat. As ſoon as the receiver was filled with thick vapours of the colouring matter, he disjoined it, and, inflaming the vapour by a little burning ſulphur introduced into the cavity, found that the air which

1196 Aerial acid and phlogiſton ſuppoſed to exiſt in it.

remained threw down a precipitate from lime-water. "Hence (ſays he) it may be concluded, that the aerial acid (A) and phlogiſton exiſt in this colouring matter."

1197 Pruſſian blue yields volatile alkali by diſtillation.

It has been aſſerted by ſeveral chemiſts, that Pruſſian blue by diſtillation always yields volatile alkali.—To determine this, Mr Scheele prepared ſome exceedingly pure from the precipitating liquor abovementioned and green vitriol; diſtilling it afterwards in a glaſs retort, to which he adapted a receiver containing a little diſtilled water. The operation was continued till the retort became red-hot. In the receiver was found the colouring matter and volatile alkali, but no oil; the air in the receiver was impregnated with aerial acid, and the ſame colouring

1198 Appearances on diſtilling other precipitates thrown down by Pruſſian alkali.

matter; the reſiduum was very black, and obeyed the magnet. On ſubſtituting, inſtead of the Pruſſian blue, the precipitates of other metallic ſubſtances precipitated by the Pruſſian alkali, the reſults were: 1. The yellowiſh brown precipitate of cobalt yielded the very ſame products with Pruſſian blue itſelf; the reſiduum in the retort was black. 2. The yellow precipitate of copper took fire, and emitted, from time to time, ſparks during the diſtillation. It produced little colouring matter, but a greater quantity of aerial acid and volatile alkali than had been obtained by the former precipitates. A ſublimate aroſe in the neck of the retort, but in too ſmall a quantity to make any experiment; the reſiduum was reduced copper. 3. The precipitate of zinc yielded the ſame with Pruſſian blue. 4. That of ſilver yielded likewiſe volatile alkali and fixed air, but chiefly colouring matter; a ſublimate containing ſome ſilver aroſe into the neck of the retort; the reſiduum was reduced ſilver. 5. Calx of mercury cryſtallized by means of the colouring matter, yielded ſome of that matter, but ſcarce any mark of volatile alkali. Some mercury, with a portion of the original compound, aroſe in the neck of the retort.

Iron.

1199 Ingredients contained in the colouring matter.

From theſe experiments Mr Scheele concluded, that the colouring matter of Pruſſian blue was compoſed of volatile alkali and an oily matter. He was confirmed in his conjecture, by obtaining Pruſſian blue from green vitriol and ſpirit of hartſhorn recently diſtilled on the addition of muriatic acid. The ſame product was obtained by means of the volatile ſpirit drawn from ox's blood; ſo that nothing now remained, but to imitate theſe natural proceſſes by artificial-

1200 Unſucceſsful attempts to prepare it artificially

ly combining the two ingredients together. For this purpoſe he diſtilled a mixture of volatile ſalt and unctuous oil; a mixture of the ſame alkali with animal fat, and with oil of turpentine; a mixture of quick-lime, ſal ammoniac, and auxunge, with others of a ſimilar kind; but in vain. He began therefore to conclude, that as long as the volatile alkali contained any water, it could not enter into an union ſufficiently intimate with the other principles to form the colouring matter; and finding alſo that the coal of blood, mixed with ſalt of tartar, yielded very good lixivium ſanguinis, he concluded that no oily matter was neceſſary for the ſucceſs of the experiment.

1201 True method of forming it.

Thus was our author led to make the following deciſive trials, which at once accompliſhed his purpoſe, and ſhowed the truth of the principles he had aſſumed. Three table-ſpoonfuls of charcoal powder were mixed with an equal quantity of alkali of tartar, and the mixture put into a crucible. A ſimilar mixture was put into another crucible, and both put into a fire, and kept red-hot for about a quarter of an hour. One of them was then taken out, and the contents thrown, while perfectly red-hot, into eight ounces of water. At the ſame time he put into the other quantity an ounce of ſal ammoniac in ſmall pieces, agitating the whole briſkly together, and taking care at the ſame time to puſh the ſal ammoniac down towards the bottom of the crucible, which he replaced in the fire. Obſerving in two minutes after, that no ammoniacal vapours aroſe, the whole maſs was thrown, when red-hot, into eight ounces of water. The former lixivium, into which no ſal ammoniac had been put, yielded no Pruſſian blue; but the latter ſhowed the ſame phenomena with the beſt lixivium ſanguinis, and produced a great quantity of blue. By mixing plumbago with the alkali inſtead of charcoal, a tolerable lixivium was obtained.

1202 Volatile alkali capable of uniting with phlogiſton and fixed alkali, ſo as to ſuſtain a great degree of heat.

"From theſe experiments (ſays Mr Scheele), it appears, that the volatile alkali is capable of uniting with the carbonaceous matter, after it has been ſubtilized by a ſtrong heat; that it thus acquires the remarkable property of combining ſo firmly with ſalt of tartar as to be able to ſuſtain the moſt violent degree of heat; and when this lixivium is diſſolved in water, there is obtained lixivium ſanguinis, as it is called.—It is now eaſy to explain what happens in the diſtil- lation



(A) This reaſoning ſeems not to be ſufficiently concluſive; for late experiments have ſhown that inflammation is generally attended with the production of fixed air, which could not be proved to have an exiſtence either in the materials or common atmoſphere before.

Iron:

lation of Prussian blue, as well as that of the other abovementioned metallic precipitates.—In the distil-
1203 Appearances on distilling Prussian blue accounted for. lation of Prussian blue, for instance, the calx of iron attracts a portion of phlogiston from the colouring matter. The aerial acid being thus disengaged, must go over into the receiver with the volatile alkali, which is set free at the same instant; but as the calx of iron in the heat of this distillation cannot unite with more phlogiston, a portion of the colouring matter, not decomposed, must likewise arise. If the calx of iron could combine with the whole of the phlogiston, there
1204 Colouring matter kept from rising by manganese. would come nothing over into the reciever but aerial acid and volatile alkali. In order to prove this, I distilled a mixture of six parts of manganese finely powdered, and one part of pulverized Prussian blue, and obtained nothing but aerated volatile alkali, without the least mark of colouring matter."

1205 The colouring matter can separate only mercury and silver from their solution in nitrous acid. Mr Scheele further remarks, that this colouring matter may probably be obtained in an aerial form, though he had not been able to do so. It is also worth notice, that, excepting the solutions of silver and mercury in nitrous acid, the colouring matter of Prussian blue is not able to decompose any other by a single elective attraction. Now, as we know that Prussian blue is not soluble in acids, it naturally follows, that the colouring matter has a greater affinity with iron than acids have, notwithstanding there is no precipitation perceived when this matter is mixed with the solution of vitriol of iron. "It may not be easy (says Mr Scheele) to give a satisfactory explanation of this phenomenon."

1206 Nitre alkalized by iron. Iron deflagrates with nitre, and renders the salt alkaline and caustic. A part of the iron is thus rendered soluble, along with the alkalized salt. A mixture of equal parts of iron filings and nitre, injected into a strongly heated crucible, and, after the detonation, thrown into water, tinges the liquor of a violet or purplish blue colour. This solution, however, is not permanent. Though the liquor at first passes through a filter, without any separation of the iron; yet, on standing for a few hours, the metal falls to the bottom, in form of a brick-coloured powder. Volatile alkalies instantly precipitate the iron from this fixed alkaline solution.

1207 Iron filings and sulphur take fire spontaneously. Iron readily unites with sulphur; and when combined with it, proves much easier of fusion than by itself. A mixture of iron filings and sulphur, moistened with water, and pressed down close, in a few hours swells and grows hot; and, if the quantity is large, bursts into flame.

By cementation with inflammable maters, iron imbibes a larger quantity of phlogiston; and becomes much harder, less malleable, and more fusible. It is then called *steel*. See Metallurgy, and Steel.

## § 5. *Lead.*

Lead is a pale or livid-white metal, soon losing its brightness in the air, and contracting a blackish or greyish ash-colour. It is the softest and most flexible of all metallic bodies; but not ductile to any great de-
1208 Has very little tenacity. gree, either in the form of wire or leaf; coming far short, in this respect, of all other metals. It has also the least tenacity of all metallic bodies; a leaden wire of $\frac{1}{10}$ of an inch diameter being capable of supporting Lead.
only $29\frac{1}{4}$ pounds. Lead has, however, a considerable specific gravity; losing, when immersed in water, between $\frac{1}{11}$ and $\frac{1}{12}$ of its weight. It is of all metals the 1209
most fusible, excepting only tin and bismuth. The Sheet-lead.
plumbers cast thin sheets of lead upon a table or mould, covered with a woollen, and above this with a linen, cloth, without burning or scorching the cloths. The melted lead is received in a wooden case without a bottom; which being drawn down the sloping table by a man on each side, leaves a sheet of its own width, and more or less thin according to the greater or less celerity of its descent. For thick plates, the table is covered over with moistened sand, and the liquid metal conducted evenly over it, by a wooden strike, which bears on a ledge at each side. 1210

Some have preferred, for mechanic uses, the milled Advantages of milled lead precarious.
lead, or flatted sheets, to the cast; as being more equal, smooth, and solid. But whatever advantage of this kind the milled sort may appear to have at first, they are not found to be very durable. When the lead is stretched between the rollers, its cavities must necessarily be enlarged. The particles of metal that may be squeezed into them can have no union or adhesion with the contiguous particles; and of consequence, must be liable, from bending, blows, jarrs, &c. to start out again, and leave the mass spongy and porous. 1211

Lead yields the dullest and weakest sound of all me- Rendered sonorous.
tallic bodies. Reaumer observes, that it is rendered sonorous by casting a small quantity into a spherical or elliptical segment, as in the bottom of an iron-laddle; from hence he conjectures, that the sound of the sonorous metals might be improved for the bells of clocks, &c. by giving them a similar form.

Though this metal very soon loses its lustre, and tarnishes in the air, it resists much longer than iron or copper the combined action of air and water, before it is decomposed or destroyed; and hence it is exceedingly useful for many purposes to which these metals 1212
can by no means be applied. When just become fluid, Calcined.
lead looks bright like quicksilver; but immediately contracts a variously coloured pellicle on the surface. If this is taken off, and the fire continued, a fresh pellicle will always be formed, till the metal is by degrees changed into a dusky powder or calx. The injection of a little fat, charcoal-powder, or other inflammable matter, prevents this change, and readily revives the calx into lead again. It is said, that lead, recovered from its calces, proves somewhat harder and whiter than at first, as well as less subject to tarnish in the air. 1213

The blackish calx or ashes of lead become of a very Minium.
different appearance if the calcination is continued with a fire so moderate as not to melt them, and particularly if exposed to flame. By this treatment it is said that they become first yellow; then they are called *massicot* or *yellow lead*. This colour becomes gradually more and more intense, till at last the calx is of a deep red; and then is called *minium* or *red lead*; but it is certain, that by proper management this calx never becomes yellow, assuming a reddish colour from the beginning. Too great a heat makes it irrecoverably yellow. It can be more easily prepared without exposure

exposure to the flame. The degree of heat necessary for converting it into minium is between 600 and 700 of Fahrenheit.

1214 Litharge.

If instead of keeping this calx in a continued moderate heat, it be suddenly fused, the matter then puts on a foliated appearance, changing to a dull kind of brick-colour when powdered, and is then called *litharge*. Most of this substance is produced by refining silver with lead (see REFINING): and is of two kinds, white and red. These two are distinguished by the names of *litharge of gold*, and *litharge of silver*. The most perfect is that called *litharge of gold*: the pale sort contains a considerable proportion of lead in its metallic state; and even the highest coloured litharge is seldom free from a little metallic lead, discoverable and separable by melting the mass in a crucible; when the lead subsides to the bottom.

1215 Phenomena with other metals.

Lead mingles in fusion with all the metals except iron, with which it refuses any degree of union as long as the lead preserves its metallic form. On continuing the fire, the lead, scorifying or calcining, absorbs the phlogistic principle of the iron, and consequently promotes the calcination of that metal; both being at length reduced to calces. The fusible calx of lead easily unites with the calx of iron, and both melt together into an opaque brown or blackish glass. Copper does not unite with melted lead till the fire is raised so high as to make the lead smoke and boil, and of a bright red heat. Pieces of copper, now thrown in, soon dissolve and disappear in the lead: the mixture, when cold, is brittle, and of a granulated texture. The union of these two metals is remarkably slight. If a mixture of copper and lead is exposed to a fire no greater than that in which lead melts, the lead almost entirely runs off by itself; a separation of which no other example is known. What little lead is retained in the pores of the copper, may be scorified, and melted out, by a fire considerably less than is sufficient to fuse copper. If any of the copper is carried off by the lead, it swims unmelted on the surface.

Gold and silver are both dissolved by lead in a slight red heat. They are both rendered extremely brittle by the minutest quantity of this metal; though lead is rendered more ductile by a small quantity of either of them. In cupellation, a portion of lead is retained by gold, but silver parts with it all. On the other hand, in its eliquation from copper, if the copper contains any of the precious metals, the silver will totally melt out with the lead, but the gold will not. The attraction of lead to copper, however slight, is greater than that of copper to iron: a mixture of copper and iron being boiled in melted lead, the copper is imbibed by the lead, and the iron thrown up to the top. Silver is in like manner imbibed from iron by lead; whilst tin, on the contrary, is imbibed from lead by iron. If two mixtures, one of lead and tin, and another of iron and silver, be melted together, the result will be two new combinations, one of the tin with the iron at the top, the other with the lead and silver at the bottom: how carefully soever the matter be stirred and mixed in fusion, the two compounds, when grown cold, are found distinct, so as to be parted with a blow.

This metal is soluble in alkaline lixivia and expressed oils. Plates of lead boiled in alkaline lixivia, have a small part dissolved, and a considerable quantity corroded: the solution stains hair black. Lead, fused with fixed alkaline salts, is in part corroded into a dark-coloured scoria, which partially dissolves in water. Expressed oils dissolve the calces of lead, by boiling, in such large quantities as to become thick and consistent: hence plasters, cements for water-works, paint for preserving nets, &c. Acids have a greater affinity with leads than oils have. If the common plaster, composed of oil and litharge, be boiled in distilled vinegar, the litharge will be dissolved, and the oil thrown up to the top. The oil thus recovered, proves soluble like essential oils in spirit of wine; a phenomenon first taken notice of by Mr Geoffroy.



1216 Soluble in alkalies and in oils.

## § 6. *Tin.*

THE colour of this metal resembles silver, but is somewhat darker. It is softer, less elastic, and sonorous, than any other metal except lead. When bent backwards and forwards, it occasions a crackling sound, as if torn asunder. It is the lightest of all the malleable metals, being little more than seven times specifically heavier than water. The tenacity of its parts also is not very considerable; a tin wire of $\frac{1}{10}$ of an inch diameter being able to support only $49\frac{1}{2}$ pounds.

1217 Capable of being beat into thin leaves.

Tin is commonly reckoned the least ductile of all metals except lead; and certainly is so, in regard to ductility into wire, but not in regard to extensibility into leaves. These two properties seem not to be so much connected with one another as is generally imagined. Iron and steel may be drawn into very fine wire, but cannot be beat into leaves. Tin, on the other hand, may be beat into very thin leaves, but cannot be drawn into wire: gold and silver possess both properties in a very eminent degree; whilst lead, notwithstanding its flexibility and softness, cannot be drawn into fine wire, or beat into thin leaves. It melts the most easily of all the metals; about the 430th degree of Fahrenheit's thermometer. Heated till almost ready to melt, it becomes so brittle that large blocks may be easily beat to pieces by a blow. The purer sort, from its facility of breaking into long shining pieces, is called *grain-tin*. Melted, and nimbly agitated at the instant of its beginning to congeal, it is reduced into small grains or powder.

1218 Calcined.

With the heat necessary for fusion, it may also be calcined; or at least so far deprived of its phlogiston as to appear in the form of a grey calx, which may be entirely reduced to tin by the addition of inflammable matter. The calcination of tin, like that of lead, begins by the melted metal losing its brightness, and contracting a pellicle on its surface. If the fire is raised to a cherry-red, the pellicle swells and bursts, discharging a small bright flame of an arsenical smell. By longer continuance in the fire, the metal is converted first into a greyish, and then into a perfectly white calx, called *putty*, which is used for polishing glass and other hard bodies.

The calx of tin is the most refractory of all others. Even in the focus of a large burning mirror, it only softens a little, and forms crystalline filaments. With glass

glaſs of biſmuth, and the ſimple and arſenicated glaſſes of lead, it forms opaque milky compounds. By this property it is fitted for making the baſis of the imperfect glaſſes called *enamels*; (ſee Glass and Enamel). The author of the Chemical Dictionary relates, "that having expoſed very pure tin, ſingly, to a fire as ſtrong as that of a glaſs-houſe furnace, during two hours, under a muffle, in an uncovered teſt, and having then examined it, the metal was found covered with an exceedingly white calx, which appeared to have formed a vegetation; under this matter was a reddiſh calx, and an hyacinthine glaſs; and laſtly, at the bottom was a piece of tin unaltered. The experiment was ſeveral times repeated with the ſame ſucceſs."

1219 Affinity of tin with arſenic.

Nitre deflagrates with tin, and haſtens the calcination of this as well as of other imperfect metals. The vapours which riſe from tin, by whatever method it is calcined, have generally an arſenical ſmell. Tin melted with arſenic falls in great part into a whitiſh calx: the part which remains uncalcined proves very brittle, appears of a white colour, and a ſparkling plated texture, greatly reſembling zinc. The arſenic is ſtrongly retained by the tin, ſo as ſcarcely to be ſeparable by any degree of fire; the tin always diſcovering, by its augmentation in weight, that it holds a portion of arſenic, though a very intenſe fire has been uſed. Hence, as the tin ores abound in arſenic, the common tin is found alſo to participate of that mineral.

1220 Arſenic ſeparable from tin.

Henckel diſcovered a method of ſeparating actual arſenic from tin; namely, by ſlowly diſſolving the tin in eight times its quantity of an aqua-regia made with ſal ammoniac, and ſetting the ſolution to evaporate in a gentle warmth: the arſenic begins to concrete whilſt the liquor continues hot, and more plentifully on its growing cold, into white cryſtals. M. Margraaf, in the Berlin Memoirs for 1746, has given a more particular account of this proceſs. He obſerves, that the white ſediment which at firſt ſeparates during the diſſolution, is chiefly arſenical; that Malacca tin, which is accounted one of the pureſt ſorts, yielded no leſs than ¼th its weight of arſenical cryſtals; that ſome ſorts yielded more; but that tin extracted from a particular kind of ore, which contained no arſenic, afforded none. That the cryſtals were truly arſenical, and appeared from their being totally volatile; from their ſubliming (a little fixed alkaline ſalt being added to abſorb the acid) into a colourleſs pellucid concrete; from the ſublimate, laid on a heated copper-plate, exhaling in fumes of a garlic ſmell; from its ſtaining the copper white: and from its forming, with ſulphur, a compound ſimilar to the yellow or ſulphurated arſenic. He found that the arſenic was ſeparable alſo by means of mercury; an amalgam of tin being long triturated with water, and the powder which was waſhed off committed to diſtillation, a little mercury came over, and bright arſenical flowers aroſe in the neck of the retort.

1221 Dr Lewis's obſervation.

Dr Lewis obſerves, that the crackling noiſe of tin in bending may poſſibly ariſe from its arſenic; as thoſe operations which are ſaid to ſeparate arſenic from the metal, likewiſe deprive it of this property.

1222 Injurious to other metals.

Tin may be allayed, in any proportion, with all metals by fuſion: but it abſolutely deſtroys their ductility, and renders them brittle, as in bell-metal; whence this metal has obtained the name of *diabolus metallorum*.



Iron is diſſolved by tin in a heat far leſs than that in which iron itſelf melts; the compound is white and brittle. Iron added to a mixture of lead and tin, takes up the tin, leaving the lead at the bottom; and in like manner, if lead, tin, and ſilver, are melted together, the addition of iron will abſorb all the tin, and the tin only. Hence an eaſy method of purifying ſilver from tin.

1223 Not liable to ruſt.

Tin notwithſtanding it is, like lead, ſoon deprived of its luſtre by expoſure to the air, is nevertheleſs much leſs liable to ruſt than either iron, copper, or lead; and hence is advantageouſly uſed for covering over the inſides of other metalline veſſels. The amalgam of mercury and tin is employed to cover one of the ſurfaces of looking-glaſſes; by which they are rendered capable of reflecting the rays of light.

1224 Aurum moſaicum.

The amalgam alſo, mixed with ſulphur and ſal ammoniac, and ſet to ſublime, yields a ſparkling gold-coloured ſubſtance called *aurum moſaicum*; which is ſometimes uſed as a pigment. This preparation is commonly made from quickſilver and tin, of each two parts, amalgamated together; and then thoroughly mixed with ſulphur and ſal ammoniac, of each one part and a half. The mercury and ſulphur unite into a cinnabar, which ſublimes along with the ſal ammoniac; and, after ſublimation, the aurum moſaicum remains at the bottom.

Sulphur may be united with tin by fuſion; and forms with it a brittle maſs, more difficultly fuſible than pure tin. Sulphur has, in this reſpect, the ſame effect upon tin as upon lead. The allay of tin leſſens the fuſibility of theſe very fuſible metals, while it increaſes the fuſibility of other difficultly fuſible metals, as iron and copper.

## § 7. *Mercury or Quicksilver.*

Mercury is a fluid metallic ſubſtance, of a bright ſilver colour, reſembling lead or tin when melted; entirely void of taſte and ſmell; extremely diviſible; and congealable only in a degree of cold very difficultly produced, in this country, by art (ſee Cold and Congelation).

1225 Heavier in winter than in ſummer.

It is the moſt ponderous of all fluids, and of all known bodies, gold and platina excepted; its ſpecific gravity being to that of water nearly as 14 to 1. It is found to be ſpecifically heavier in winter than in ſummer by 25 grains in 11 ounces

Neither air nor water, nor the united action of theſe two, ſeem to make any impreſſion upon mercury: nor is it more ſuſceptible of ruſt than the perfect metals. Its ſurface, nevertheleſs, is more quickly tarniſhed than gold or ſilver; becauſe the duſt which floats in the air, quickly ſeizes on its ſurface. The watery vapours alſo, which float in the air, ſeem to be attracted by mercury.

1226 Purification.

From theſe extraneous matters, which only ſlightly adhere to it, mercury may be eaſily cleanſed by paſſing it through a clean new cloth, and afterwards heating it: but if mixed with any other metal, no ſeparation can be effected without diſtillation. In this proceſs, a ſmall portion of ſome of the metals generally ariſes along with the mercury. Thus, quickſilver

Mercury or quickſilver.

ver diſtilled from lead, biſmuth, or tin, appears leſs bright than before; ſtains paper black; ſometimes exhibits a ſkin upon the ſurface; and does not run freely, or into round globules. Mr Boyle relates, that he has obſerved the weight of mercury ſenſibly increaſed by diſtillation from lead, and this when even a very moderate fire was made uſe of. By amalgamation with ſtellated regulus of antimony, and then being diſtilled after a few hours digeſtion, mercury is ſaid to become, by a few repetitions of the proceſs, more

1227 Curious mercuries by Boyle.

ponderous, and more active. The animated, or philoſophic mercuries of ſome of the alchemiſts, are ſuppoſed to have been mercury thus prepared. By the ſame, or ſimilar proceſſes, ſeem to have been obtained the curious mercuries which Boyle declared he was poſſeſſed of, and made himſelf; which were "conſiderably heavier in ſpecie than common quickſilver,—diſſolved gold more readily,—grew hot with gold, ſo as to be offenſive to the hand, and elevated gold in diſtillation." When quickſilver is to be diſtilled, it is proper to mingle it with a quantity of iron-filings; which have the property of making it much brighter than it can be otherwiſe obtained, probably by furniſhing phlogiſton.

By digeſtion in a ſtrong heat for ſeveral months, mercury undergoes a conſiderable alteration, changing into a powder, at firſt aſh-coloured, afterwards yellow, at length of a bright red colour, and an acrid

1228 Mercurius precipitatus per ſe.

taſte; and is then called *mercurius precipitatus per ſe*. In this laſt ſtate it proves ſimilar to the red precipitate, prepared from a ſolution of mercury in nitrous acid. This calx proves leſs volatile in the fire than the mercury in its fluid ſtate. It ſupports for ſome time even a degree of red heat. In the focus of a burning mirror, it is ſaid to melt into glaſs when laid upon a piece of charcoal, and to revive into running mercury before it exhales. Evaporated by common fire, it leaves a ſmall portion of a light brown powder; which, Boerhaave relates, bore a blaſt-heat; ſwelled into a ſpongy maſs; formed with borax a vitreous friable ſubſtance; but vaniſhed in cupellation.

1229 Mercury unalterable by a gentle heat;

By a long continued digeſtion in a gentle heat, mercury ſuffers little change. Boerhaave digeſted it in low degrees of heat, both in open and cloſe veſſels, for 15 years together, without obtaining any other reward for his labour than a ſmall quantity of black powder; which, by trituration, was quickly revived into running mercury. Conſtant triture, or agitation, produce a change ſimilar to this in a ſhort time. Both the black and red powders, by bare expoſure to a fire ſufficient to elevate them, return into fluid mercury. The red powder has been revived by ſimply grinding it in a glaſs mortar.

1230 Or by diſtillation.

In like manner, quickſilver remains unchanged by diſtillation. Boerhaave had the patience to diſtil 18 ounces of mercury upwards of 500 times over, without obſerving any other change than that its fluidity and ſpecific gravity were a little increaſed, and that

1231 Exploſion by the vapours of mercury.

ſome grains of a fixed matter remained. The vapours of mercury, like thoſe of all other volatile bodies, cauſe violent exploſions if confined. Mr Hellot gives an account of his being preſent at an experiment of this kind: a perſon pretending to fix mercury, had incloſed it in an iron box cloſely welded. When the mercury was heated, it burſt the box, and diſſipated in inviſible vapours.

Mercury or quickſilver.

1232 Amalgamated with different ſubſtances.

Mercury diſſolves or unites with all metallic bodies, except three, *viz.* iron, arſenic, and nickel: in ſome caſes it will abſorb metals, particularly gold and ſilver, from their ſolutions in acids or alkalies; but does not act upon any metal when combined with ſulphur, nor on precipitates made by alkalies, nor on calces by fire. Whatever metal it is united with, it conſtantly preſerves its own white colour. It unites with any proportion of thoſe metallic ſubſtances with which it is capable of being combined; forming, with different quantities, amalgams of different degrees of conſiſtence. From the fluid ones, greateſt part of the quickſilver may be ſeparated by colature. Biſmuth is ſo far attenuated by mercury, as to paſs through leather with it in conſiderable quantity. It alſo promotes the action of quickſilver upon lead to a great degree; ſo that mercury united with $\frac{1}{4}$, $\frac{1}{8}$, or $\frac{1}{12}$ its weight of biſmuth, diſſolves maſſes of lead in a gentle warmth, without the agitation, triture, comminution, or melting heat neceſſary to unite pure mercury with lead. From theſe properties, this ſolution of biſmuth in mercury becomes a proper ſolvent for pieces of lead lodged in the human body.

1233 Separation of the amalgamated metal.

On triturating or digeſting amalgams for a length of time, a blackiſh or duſky-coloured powder ariſes to the ſurface, and may be readily waſhed off by water. Some of the chemiſts have imagined, that the amalgamated metal was here reduced to its conſtituent parts: but pure mercury is by itſelf reducible to a powder of the ſame kind; and the metallic particles in this proceſs, united with the mercury, are found to be no other than the metal in its entire ſubſtance. Some metals ſeparate more difficultly than others; gold and ſilver the moſt ſo. Boerhaave relates, that if the powder which ſeparates from an amalgam of lead be committed to diſtillation with vinegar in a tall veſſel, the mercury will ariſe before the vinegar boils; that, by a like artifice, quickſilver may be made to diſtil in a leſs degree of heat than that of the human body: but Dr Lewis, though he made many trials, was never able to ſucceed.

1234 Becomes fixed by amalgamation with gold.

By amalgamation with gold, mercury may become exceedingly fixed; ſo as not to be diſſipable by the greateſt heat. Concerning this, Dr Brandt relates the following curious experiment: "Having amalgamated fine gold with a large proportion of quickſilver, and ſtrained off the ſuperfluous mercury, he digeſted the amalgam in a cloſe ſtopped veſſel for two months with ſuch a degree of heat, that a part of the quickſilver ſublimed into the neck of the glaſs. The matter being then ground with twice its weight of ſulphur, and urged with a gradual fire in a crucible, a ſpongy calx remained; which being melted with borax, and afterwards kept in fuſion by itſelf for half an hour, in a very violent fire, ſtill retained ſo much of the quickſilver as to become brittle under the hammer, and appear internally of a leaden colour. The metal being again amalgamated with freſh mercury, the amalgam again ground with ſulphur, and expoſed to an intenſe fire, a ſpongy calx remained as before. This calx being digeſted in two or three freſh parcels of aqua-regia, a ſmall portion of whitiſh matter remained

Mercury or quicksilver.

ed at last undissolved. The paper which covered the cylindrical glass wherein the digestion was performed, contracted, from the vapours, a deep-green circular spot in the middle, with a smaller one at the side; whereas the aqua-regia digested in the same manner by itself, or with gold, or with mercury, gave no stain. The first solution, on the addition of oil of tartar *per deliquium*, grew red as blood; on standing, it deposited, first, a little yellow calx, like aurum fulminans; afterwards, a bright matter like fine gold; and at last, a paler precipitate, inclining to green; its own deep red colour and transparency remaining unchanged. Being now committed to distillation, a colourless liquor arose; and the residuum, perfectly exsiccated, yielded, on edulcoration, a yellow calx of gold; which the alakaline lixivium had been unable to precipitate. The second solution turned green on the admixture of the alkaline liquor, and let fall a white precipitate, which turned black and brown. The several precipitates were calcined with twice their weight of sulphur, and then melted with four times their quantity of flint, and twelve of pot-ash, in a fire vehemently excited by bellows. The scoria appeared of a golden colour, which, on pulverization and edulcoration, vanished. At the bottom was a regulus, which looked bright like the purest gold; but was not perfectly malleable. Broken, it appeared internally white; and the white part amounted to at least one-third its bulk Besides this lump of metal, there were several others, white like silver, and soft as lead."

1235 Supposed to be convertible into water.

In Wilson's chemistry, we have a process for converting quicksilver into water, by dropping it by little and little into a tall iron vessel, heated almost to a white heat in the bottom. Over the mouth of this vessel were luted seven aludels; and on the top, a glass alembic head, with a beak, to which was fitted a receiver. The mercury was put in so slowly, that it required 16 hours for one pound. Every time that a little quantity of mercury was put in, it made a great noise, filling the aludel's head and receiver with white fumes. When the vessels were cooled, a little water was found in each of the receivers, and in the first and second some grains of crude mercury. The whole quantity amounted to 13 ounces and 6 drachms; which was expected to prove a powerful solvent of gold and silver: but, on trial, was found to be in no respect different from common water. On this experiment Dr Lewis has the following note.

1236 Dr Lewis's detection of the falsehood of this process.

"The possibility of converting mercury into water, or at least of obtaining a great quantity of water from mercury, has not only been believed by several great men in the chemical art, but some have even ventured to assert that they have actually made this change. Yet, nevertheless, they have delivered the history of this affair with such marks, as seem to make the reality of the change extremely doubtful. Mr Boyle (in his tract *of the producibleness of Chemical Principles*, annexed to *Scept. Chemist.* p. 235) says, "that he once obtained water from mercury without additament, without being able to make the like experiment succeed afterwards." M. Le Febure, who is generally looked upon as an honest practitioner, directs a process similar to that above (Wilson's), for obtaining of this mercurial water. But it is to be suspected, as Mr Hales very well observes (in his *Statical Experiments*, p. 200.), that Mr Boyle and others were deceived by some unheeded circumstance, when they thought they obtained a water from mercury, which should seem rather to have arisen from the lute and earthen vessels made use of in the distillation: for Mr Hales could not find the least sign of any moisture upon distilling mercury in a retort made of an iron gun-barrel, with an intense degree of heat; although he frequently cohobated the mercury which came over into the recipient. "In a course of chemical experiments, I repeated Mr Hales's process, and urged the mercury, which was let fall by little and little, through an aperture made in the gun-barrel, with a most intense degree of heat, without obtaining any water; but it being suspected by a bystander, that the mercury in this experiment came over before it had been sufficiently acted upon by the fire, by reason of the lowness of the neck of the distilling instrument, the experiment was varied in the following manner. Sixteen ounces of mercury were heated in a crucible, in order to evaporate any moisture that might have been accidentally mixed with it; and an iron gun-barrel of four feet in length, being placed perpendicularly in a good furnace, and a glass-head and recipient fitted to its upper part, the mercury was let fall by little and little into the barrel, and the fire urged with bellows. After each injection, the mercury made a considerable noise and ebullition, and arose into the head; where it soon condensed and trickled down, in the common form of running mercury, into the recipient, without the least perceptible appearance of any aqueous humidity." 1237

How to amalgate with regulus of antimony.

Mercury is difficultly amalgamated with regulus of antimony and copper; for which some particular manoeuvres are required. Two of Dr Lewis's receipts for uniting quicksilver with copper, we have already given (n° 1153.): with regulus of antimony, mercury, he says, may be perfectly united, by pouring a small stream of melted regulus into a considerable portion of mercury, made almost boiling hot. Another method directed by Henckel, is to put mercury into an iron mortar along with some water, and set the whole over the fire. When the water boils, a third or fourth part of melted regulus is to be poured in, and the mass ground with a pestle, till the amalgam is completed. The use of the water, as Dr Lewis observes, is to hinder the mercury from flying off by the heat of the regulus: but as the two are by this means not put together in so hot a state, the union is more difficult, and less perfect. The loss of the mercury, in the first process, may be prevented by using a large vessel, and covering it with a perforated iron-plate, through the hole in which the regulus is to be poured. This method is likewise applicable to the amalgamation of copper.

With sulphur, mercury unites very readily, forming by trituration, or simple fusion, a black powder or mass, called *Ethiops mineral*; which, by careful sublimation, becomes the beautiful red pigment called *vermillion*. (See Sulphur, sect. iv.).

The extensive use of mercurius dulcis in medicine has rendered it an object to chemists to find out some method of preparing it with less expence and trouble, and with more certainty of its effects, than it can be by the methods hitherto mentioned. This is now accomplished 1238

Preparations of mercurius dulcis in the moist way.

Mercury of quicksilver. plished through the industry of Mr Scheele, to whom chemistry in general has been so much obliged. His method is as follows:

"Take half a pound of quicksilver, and as much pure common aquafortis. Pour it into a small cucurbit with a pretty long neck, stop the mouth with a little paper, and put it into warm sand. Some hours afterwards, when the acid appears no longer to act upon the quicksilver, the fire is to be augmented so as to make the solution nearly boil. This heat is to be continued for three or four hours, and the vessel now and then to be shaken. Towards the end, regulate the heat in such a manner that the solution shall gently boil for a quarter of an hour. In the mean time, dissolve 4½ ounces of pure common salt in six or eight pounds of water; pour this solution, still boiling, into a glass vessel, and immediately afterwards mix with it the abovementioned solution of quicksilver, which also must be boiling, in small quantities at a time, with constant agitation. When the precipitate has settled, decant off the clear liquor, and pour hot water again on the precipitate, with which it is to be edulcorated till the water standing upon it shall be entirely tasteless. Put the whole, obtained by these means, together, filter and dry it in a mild heat."

1239 How to obtain a perfectly saturated solution of quicksilver.

On this process it is remarked, that when the quicksilver no longer effervesces with the acid, one would imagine that a saturation had taken place. But this is far from being the case. By increasing the heat the solution is still able to dissolve a great quantity; with this difference, however, that, whereas the quicksilver in the beginning is calcined, a great deal of it afterwards, in a metallic form, is dissolved, as appears from this, that not only no more elastic vapours ascend; but also, that with fixed and volatile caustic alkalies, a black precipitate is obtained; otherwise, when the solution contains only calcined quicksilver, the precipitate is yellow. If the black precipitate be gently distilled, quicksilver arises, and there remains a yellow powder, which is that part of the metal that was calcined by the nitrous acid. The fire must at any rate be augmented, in order to keep the mercurial calx dissolved, the compound of this metal and nitrous acid being extremely apt to crystallize even in the heat. There commonly remains some undissolved quicksilver; but it is always better to take too much than too little; for the more metal the mercurial solution contains, the more mercurius dulcis is obtained at last. The quantity here mentioned usually produces 8¼ ounces of mercurius dulcis. The mercurial solution must be cautiously poured into that of sea-salt, that no mercury may follow. Two ounces of salt would be sufficient for the precipitation of all the quicksilver; but when so small a quantity is used, it may easily happen, that some superabundant corrosive sublimate may adhere to the precipitate, which water alone is incapable of entirely separating. Among other advantages this method of making mercurius dulcis possesses, it is none of the least, that the powder is much finer than any to which it can be reduced in the common way by trituration, however long continued.

## § 8. *Zinc.*

This is a semimetal of a bluish white colour. It is the least brittle of any of the semimetals; and when amply supplied with phlogiston, which may be done by treating it in close vessels with inflammable matters, it possesses a semiductility, by which it may be flattened into thin plates. When broken, it appears formed of many flat shining plates or facets, which are larger when slowly than when hastily cooled. When heated, it is very brittle; and crackles like tin, only louder, when bent. Exposed to the air, it contracts in length of time a yellowish rust. Its specific gravity, according to Dr Lewis, is to that of water as $7\frac{1}{10}$ to 1. It begins to melt as soon as red-hot; but does not flow thin till the fire is raised to a white heat. Then the zinc immediately begins to burn with an exceedingly bright and beautiful flame. Kept just in fusion, it calcines slowly; not only on the upper surface, but likewise round the sides, and at the bottom of the crucible. If several pieces are just melted together, the mass, when grown cold, may be broken into the same number; their union being prevented by a yellowish calx, with which each piece is covered over. M. Malouin relates, in the French Memoirs for 1742, that a quantity of zinc being melted six times, and the fusion continued fifteen hours each time, it proved, on every repetition, harder, more brittle, less fusible, and less calcinable; that after the two first fusions, its colour was grey; after the third, brown; and after the fourth, black; that the fifth rendered it of a slate-blue; and the sixth of a clear violet.

Zinc.

1240 Deflagration.

1241 Flowers of zinc.

So violent is the deflagration of zinc, that the whole of its calx is sublimed by it, in the form of light flocks of wool; which, however, are easily reduced to a fine powder. These are used in medicine, and reckoned an excellent remedy in epileptic cases. When once sublimed, they are by no means capable of being elevated again by the most violent heat. In a heat far greater than that in which they first arose, they suffer no alteration; in a very vehement one, they melt, according to Henckel, into a semiopaque green glass. Vitrified with borax, they give a grey, or brownish, glass. From the brightness of the flame of burning zinc, and the garlic smell which it is said to emit, some have concluded that zinc contained the phosphorine acid; which, from some other circumstances, is not altogether improbable.

1242 Dr Lewis's method of reducing them.

The flowers of zinc have been thought very difficultly, or not at all, reducible to their metallic form by an addition of phlogiston. But Dr Lewis observes, that this difficulty proceeds not from their unfitness to be restored into the form of zinc, but from the volatility of the semimetal, which occasions its being dissipated in fumes, if the common methods are made use of. All calces, these of iron excepted, require a greater heat for their fusion than that in which the metal itself melts; and as a full melting heat is the greatest that zinc can sustain, it burns and calcines the instant of its revival, if the air is admitted; and in close vessels escapes, in part at least, through their pores. On mixing flowers of zinc with powdered charcoal, and urging them with a strong fire in a crucible, a deflagration and fresh sublimation ensue: sufficient marks that the zinc has been reduced to its metallic form; for as long as it remains in the state of calx, neither of these effects can happen. If the vessel is so contrived

trived as to exclude the air, and at the same time to allow the reviving semimetal to run off from the vehemence of the heat, into a receiver kept cool, the zinc will there concrete, and be preserved in its metallic state. It is still more effectually detained by certain metallic bodies, as copper, or iron; with which the zinc, when thus applied, unites more readily and perfectly than it can be made to do by any other means.

1243 Oil from flowers of zinc by Mr Homberg.

Homberg pretended to obtain an oil from the flowers of zinc, by dissolving them in distilled vinegar, and then distilling the solution in a glass retort. At first a quantity of phlegm arose; then the superfluous acid; and at last an empyreumatic oil. This last, which Homberg imagined to proceed from the flowers of zinc, Newmann very justly attributes to the distilled vinegar.

1244 Another by Mr Hellot.

An oil of another kind was obtained by Mr Hellot from the above solution, by digesting the ash-coloured residuum, which remained after the distillation, with the acidulous phlegm which came over, for eight or ten days; distilling the tincture to dryness; and repeating the extraction with the distilled liquor, till the quantity of dry extract thus obtained was very considerable. This resin-like matter, distilled in a retort with a stronger fire, yielded a yellowish liquor, and a white sublimate. The liquor discovered no mark of oil; but, upon being passed upon the sublimate, immediately dissolved it, and then exhibited on the surface several drops of a reddish oil. Some of this oil was taken up on the point of a pencil, and applied to gold and silver-leaf. In twenty-four hours the parts touched appeared, in both, equally dissolved.

1245 Zinc with other metals.

Zinc does not unite in fusion with bismuth, or the semimetal called *nickel*. It unites difficultly with iron; less so with copper; easier with the other metals. It renders iron or copper more easily fusible; and, like itself, brittle whilst hot, though considerably malleable when cold.

1246 Materials for specula.

It brightens the colour of iron almost into a silver hue, and changes that of copper into a yellow or gold colour. It greatly debases the colour of gold; and renders near an hundredth part of that most ductile metal brittle and untractable. A mixture of equal parts of each is very hard, white, and bears a fine polish; hence it is proposed by Mr Hellot for making specula. It is not subject to rust or tarnish in the air, like those metals whose basis is copper. It improves the colour and lustre of lead and tin, renders them firmer, and consequently fitter for several mechanic uses. Tin, with a small proportion of zinc, forms a kind of pewter. Lead will bear an equal weight, without losing too much of its malleability. Maoluin observes, that arsenic, which whitens all other metals, renders zinc black and friable; that when the mixture is performed in close vessels, an agreeable aromatic odour is perceived on opening them; that zinc amalgamated with mercury, and afterwards recovered, proves whiter, harder and more brittle than before, and no longer crackles on being bent.

1247 Deflagration of zinc with other metals.

Mixtures of zinc with other metals, exposed to a strong fire, boil and deflagrate more violently than zinc by itself. Some globules of the mixture are usually thrown off during the ebullition, and some part of the metal calcined and volatilized by the burning zinc: hence this substance has been called *metallic nitre*. Gold itself does not entirely resist its action. It very difficultly volatilizes copper; and hence the sublimates obtained in the furnaces where brass is made, or mixtures of copper and zinc melted, are rarely found to participate of that metal. On melting copper and zinc separately, and then pouring them together, a violent detonation immediately ensues, and above half the mixture is thrown about in globules.

1248 Cannot be united with sulphur.

Zinc does not unite in the least with sulphur, or with crude antimony, which scorify all other substances except gold and platina; nor with compositions of sulphur and fixed alkaline salts, which dissolve gold itself. With nitre it deflagrates violently. Its flowers do not sensibly deflagrate; yet alkalize double their weight of the salt more readily than the zinc itself.

1249 Nitre alkalized by flowers of zinc.

The alkaline mass appears externally greenish, internally of a purple colour. It communicates a fine purple to water, and a red to vinegar. The acetous tincture inspissated, leaves a tenacious substance which soon runs in the air into a dark red caustic liquor, the alkahest of some of the pretended adepts.

## § 9. Bismuth.

This semimetal, called, also *tin-glass*, and by some naturalists *marcasita officinarum*, is somewhat similar to the regulus of antimony. It appears to be composed of cubes formed by the application of plates upon each other. Its colour is less white than that of regulus of antimony; and has a reddish tinge, particularly when it is exposed to the air. In specific gravity it approaches to silver; being nearly ten times heavier than water. It has no degree of malleability; breaking under the hammer, and being reducible by trituration to fine powder. It melts a little later than tin, and seems to flow the thinnest of all metallic substances.

1250 Convertible into litharge and glass.

Bismuth is semivolatile, like all other semimetals. When exposed to the fire, flowers rise from it; it is calcined; and converted into a litharge and glass nearly as lead is; (See Glass). It may even be employed, like that metal, in the purification of gold and silver by cupellation. (See Refining). When in fusion, it occupies less volume than in its solid state: a property peculiar to iron among the metals, and bismuth among the semimetals. It emits fumes in the fire as long as it preserves its metallic form; when calcined or vitrified, it proves perfectly fixed.

1251 Promotes the fusion of all the metals,

Bismuth mingles in fusion with all the metalline substances, except regulus of cobalt and zinc. The addition of nickel or regulus of antimony, renders it miscible with the former, though not with the latter. It greatly promotes the tenuity as well as facility of the fusion of all those metals with which it unites. It whitens copper and gold, and improves the colour of some of the white metals: mixed in considerable quantity; it renders them all brittle, and of a flaky structure like its own. If mixed with gold or silver, a heat that is but just sufficient to melt the mixture, will presently vitrify a part of the bismuth; which, having then no action on those perfect metals, separates, and glazes the crucible all round.

Regulus of antimony.

§ 10. *Regulus of Antimony.*

1252 Appearance of a star on its surface.

This femimetal, when pure, and well fufed, is of a white fhining colour, and confifts of laminæ applied to each other. When it has been well melted, and not too haftily cooled, and its furface is not touched by any hard body during the cooling, it exhibits the perfect figure of a ftar, confifting of many radii iffuing from a centre. This proceeds from the difpofition that the parts of this femimetal have to arrange themfelves in a regular manner, and is fimilar to the cryftallization of falts.

Regulus of antimony is moderately hard; but, like other femimetals, it has no ductility, and breaks in fmall pieces under a hammer. It lofes $\frac{1}{7}$ of its weight in water. The action of air and water deftroys its luftre, but does not ruft it fo effectually as iron or copper. It is fufible with a heat fufficient to make it red

1253 Sublimable.

hot; but when heated to a certain degree, it fumes continually, and is diffipated in vapours. Thefe fumes form what are called the *argentine flowers* of regulus of antimony, and are nothing but the earth of this femimetal deprived of part of its inflammable principle, and capable of being reduced to its reguline ftate by an union with this principle.

1254 Separation of the fulphur from antimony.

There are different methods of preparing the regulus of antimony; but all of them confift merely in feparating the fulphur which this mineral contains, and which is united with the regulus. It is plain, therefore, that regulus of antimony may be made by an addition of any fubftance to crude antimony in fufion, which has a greater attraction for fulphur than the regulus itfelf has. For this purpofe, alkaline falts have been employed, either previoufly prepared, or extemporaneoufly produced in the procefs, by a deflagration of tartar and nitre. By this means, the fulphur was indeed abforbed; but the hepar fulphuris, formed by the union of the fulphur and alkali, immediately diffolved the regulus, fo that very little, fometimes none at all, was to be obtained diftinct from the fcoria. Metals are found to anfwer better than alkaline falts, but the regulus is feldom or never free from a mixture of the metal employed. The way of obtaining a very pure regulus, and in great quantity, is to calcine the antimony in order to diffipate its fulphur; then to mix the calx with inflammable matters, fuch as oil, foft foap, &c. which are capable of reftoring the principle of inflammability to it. This method was invented by Kunckel. Another, but more expenfive way of procuring a large yield of very pure regulus, is, by digefting antimony in aqua-regis, which diffolves the reguline part, leaving the fulphur untouched, precipitating the folution, and afterwards reviving the precipitate by melting it with inflammable matters.

1255 Regulus eafily mifcible with mercury.

There are confiderable differences obferved in the regulus of antimony, according to the different fubftances made ufe of to abforb the fulphur. When prepared by the common methods, it is found to be very difficultly amalgamated with mercury; but Mr Pott has difcovered, that a regulus prepared with two or five parts of iron, four of antimony, and one of chalk, readily unites with mercury into an hard amalgam, by bare trituration with water. Marble and quicklime fucceed equally well with chalk; but clay, gypfum, or other earths, have no effect.

Regulus of antimony.

1256 Extemporaneous regulus with cawk.

One earthy fubftance, found in lead-mines, and commonly called *cawk*, has a very remarkable effect upon antimony. This is found in whitifh, moderately compact and ponderous maffes; it is commonly fuppofed a fpar; but differs from bodies of this kind, in not being acted upon by acids, (fee n° 1068). If a lump of cawk, of an ounce or two, be thrown red hot into 16 ounces of melted antimony, the fufion continued about two minutes, and the fluid matter poured off, "you will have 15 ounces like polifhed fteel, and as the moft refined quickfilver." *Phil. Tranf.* n° 110. Dr Lewis mentions his having repeated this experiment feveral times with fuccefs: but having once varied it by mixing the cawk and antimony together at the firft, a part of the antimony was converted into a very dark black vitreous matter, and part feemed to have fuffered little change; on the furface of the mafs fome yellow flowers appeared.

Regulus of antimony enters into the compofitions for metallic fpeculums for telefcopes, and for printing-types. It is alfo the bafis of a number of medicinal preparations; but many of thefe, which were formerly much efteemed, are found to be either inert, uncertain, or dangerous in their operations. When taken in fubftance, it is emetic and purgative, but uncertain in its operation; becaufe it only acts in proportion to the quantity of folvent matter it meets with in the ftomach; and if it meets with nothing capable of acting upon it there, the regulus will be quite inactive. For thefe reafons, the only two preparations of antimony now retained, at leaft by fkilful practitioners, are the infufion of glafs of antimony in wine and emetic tar-tar. For making the glafs of antimony we have the following procefs. "Take a pound of antimony; reduce it to fine powder, and fet it over a gentle fire; calcine it in an unglazed earthen pan, till it comes to be of an afh colour, and ceafes to fume: you muft keep it continually ftirring; and if it fhould run into lumps, you muft powder them again, and then proceed to finifh the calcination. When that is done, put the calcined antimony into a crucible; fet it upon a tile in a wind-furnace; put a thin tile on the top; and cover it all over with coals. When it is brought into fufion, keep it fo in a ftrong fire for an hour: then put into it an iron rod; and when the melted antimony, which adheres to it, is tranfparent, pour it upon a fmooth, hot, marble; and when it is cold, put it up for ufe. This is *vitrum antimonii*, or *ftibium*." 1257 Glafs of antimony.

This preparation is more violent in its effects than the pure regulus itfelf; becaufe it contains lefs phlogifton, confequenly is fimilar to a regulus partially calcined, and fo more foluble. Hence it is the moft proper for infufion in wine, or for making the tartar emetic. It is obvioufly, however, liable to great uncertainties in point of ftrength; for as the antimony is more or lefs ftrongly calcined, the glafs will turn out ftronger or weaker in its operation, and confequently all the preparations of it muft be liable to much uncer- 1258

tainty. This uncertainty is very apparent in the ftrength of different parcels of emetic tartar: accordingly Mr Geoffroy found by examination of different emetic tartars, that an ounce of the weakeft contain-ed Difference of ftrength in emetic tartars.

Rugulus of antimony.

ed from 30 to 90 grains of regulus; an ounce of moderate strength contained about 108 grains; and an ounce of the strongest kind contained 154 grains. For these reasons, the author of the Chemical Dictionary recommends the pulvis algaroth as the most proper material for making emetic tartar; being per-

1259 Pulvis algaroth the most proper material for emetic tartar.

fectly soluble, and always of an equal degree of strength. Emetic tartar, as he justy observes, ought to be a metallic salt composed of cream of tartar saturated with the regulus of antimony; and M. Beaumé has shown such a saturation to be possible, and that the neutral salt crystallizes in the form of pyramids. They are transparent while moist; but by exposure to a dry air, they lose the water of their crystallization and become opaque. The preparation of this salt, according to M. Baumé, consists in mixing together equal parts of cream of tartar, and levigated glass of antimony: these are to be thrown gradually into boiling water; and the boiling continued till there is no longer any effervescence, and the acid is entirely saturated. The liquor is to be filtered; and upon the filter is observed a certain quantity of sulphureous matter along with some undissolved parts of the glass of antimony. When the filtered liquor is cooled, fine crystals will be formed in it, which are a soluble tartar perfectly saturated with glass of antimony. He observes, that the dissolution is soon over if the glass is well levigated, but requires a long time if it is only grossly pounded.

1260 Objection to its use.

The trouble of levigating glass of antimony, as well as the uncertainty of dissolving it, would render *pulvis algaroth* much preferable, were it not on account of its price; which would be a temptation to those

1261 Scheele's theory of the nature of pulvis algaroth.

in use to prepare medicines, to substitute a cheaper antimonial preparation in its place. This objection, however, is now in a great measure removed by Mr Scheele; who demonstrated that the pulvis algaroth is no other than regulus of antimony half calcined by the dephlogisticated marine acid in the corrosive sublimate made use of for preparing the antimonial caustic. If therefore we can fall upon any other method of dephlogisticating the regulus, we shall then be able to combine the marine acid with it; and by separating them afterwards, may have the powder of algaroth as good as from the butter of antimony itself. One of the methods of dephlogisticating the regulus is by nitre. Our author therefore gives the following receipt for the powder in question.

1262 His receipt for making it cheap.

"Take of powdered crude antimony one pound; powdered nitre, one pound and a half; which, after being well dried and mixed, are to be detonated in an iron mortar. The hepar obtained in this manner is to be powdered, and a pound of it to be put into a glass vessel, on which first a mixture of three pounds of water and 15 ounces of vitriolic acid is to be poured, and afterwards 15 ounces of powdered common salt are to be added; the glass vessel is then to be put in a sandbath, and kept in digestion for 12 hours, during which period the mass is to be constantly stirred. The solution, when cool, is to be strained through linen. On the residuum one third of the above menstruum is to be poured, and the mixture digested and strained. From this solution, when it is diluted with boiling water, the pulvis algarothi precipitates, which is to be well edulcorated and dried."

As regulus of antimony, like other metallic substances, is soluble in liver of sulphur, it happens, that, on boiling antimony in an alkaline ley, the salt, uniting with the sulphur contained in that mineral, forms an hepar sulphuris, which dissolves some of the reguline part. If the liquor is filtered, and saturated with an acid, the regulus and sulphur will fall together in form of a yellowish or reddish powder, called *golden sulphur of antimony*. If the ley is suffered to cool, a like precipitation of a red powder happens. This last is called *kermes mineral*.

Arsenic.

1263 Golden sulphur of antimony and kermes mineral.

1263 Diaphoretic antimony.

Nitre deflagrates violently with antimony, consuming not only its sulphureous part, but also the phlogiston of the regulus: and thus reduces the whole to an inert calx, called *antimonium diaphoreticum*. If equal parts of nitre and antimony are deflagrated together, the sulphureous part is consumed, as well as part of the inflammable principle of the regulus. The metalline part melts, and forms a semivitreous mass of reddish colour, called *crocus metallorum*, or *liver of antimony*. It is a violent emetic, and was formerly used for making infusions in wine similar to those of glass of antimony; but is now disused on account of its uncertainty in strength. It is still used by the farriers: but the substance sold for it is prepared with a far less proportion of nitre; and sometimes even without any alkaline salt being added to absorb part of the antimonial sulphur. This crocus is of a dull red colour; and, when powdered, assumes a dark purple.

1265 Crocus metallorum.

## § II. *Arsenic.*

This substance, in its natural state, has no appearance of a metal, but much more resembles a salt, which, as has been already observed, it really is when deprived of its phlogiston. When united to a certain quantity of phlogiston, it assumes a metallic appearance; and in this state it is found, as Mr Bergman informs us, in Bohemia, Hungary, Saxony, Hercynia, and other parts; particularly at Alsatia in the mines called *St Marieux*. The masses in which it is found are frequently shapeless, friable, and powdery; but sometimes compact, and divided into thick convex lamellæ, with a needle-formed or micaceous surface: it takes a polish, but soon loses it again in the air. When fresh broken, it appears composed of small needle-like grains of a leaden colour, soon becoming yellow, and by degrees blackish; exceeding copper in hardness, though as brittle as antimony.

1266 Arsenic found naturally in a metallic form.

1267 Regulus of arsenic easily converted into the common white kind.

Reguline arsenic, whether found naturally or prepared by art, very readily parts with as much of its phlogiston as is sufficient to make it fly off in a white smoke; but this still retains a very considerable quantity of phlogistic matter, as is evident from its producing nitrous air by the affusion of nitrous acid, and from the experiments already related of the preparation of the acid of arsenic. This calx indeed is the form in which arsenic is most commonly met with. It is less volatile than the regulus; and by sublimation in a glass vessel assumes an opaque crystalline appearance from becoming white on the surface; but that which crystallizes in the bowels of the earth does not appear to be subject to any such change.

1268 White arsenic may be mixed with other metals.

White arsenic, though a true metalline calx, may be mixed in fusion with the same metals which will unite with the regulus. This seems contrary to the general rule of other calces, which cannot be united with any metal

metal in its metalline state; but it must be remembered, that by this operation the arsenical calx is reduced to a regulus by the phlogiston of the metal: whence, in all fusions of this kind, some scoriæ rise to the top, consisting of the calcined metal and part of the white arsenic.

1269 Solution of arsenic in water. Eight parts of distilled water dissolve, by means of moderate heat, one part of calcined arsenic, and by boiling may be made to take up 15. The solution changes syrup of violet green, but the tincture of turnsole red. It is not changed by neutral salts, but slowly precipitates the solutions of metals, the arsenic united to the metallic calx falling to the bottom.—"It may be asked (says Mr Bergman), whether the whole of the arsenic, or only the arsenical acid, unites with the metallic calx, yielding the phlogiston to the menstruum of the other metal?" Certainly such a mutual commutation of principles does not appear improbable, if we consider only those cases in which the menstruum is vitriolic or nitrous acid: but as iron, for example, united with marine acid (which does not attract the phlogiston of white arsenic), as well as when it is joined to the nitrous acid, is precipitated, it would appear that the whole of the arsenic is united, at least in certain cases, to the metallic calces.

1270 And in spirit of wine. One part of arsenic is dissolved by 70 or 80 of boiling spirit of wine.

1271 In vitriolic acid. Arsenic dissolves partially in concentrated vitriolic acid, but concretes in the form of crystalline grains on cooling. These dissolve in water with much greater difficulty than the arsenic itself. On the blow-pipe they emit a white smoke, but form into a globule by fusion, which at first bubbles, but soon grows quiet, and is but slowly consumed even in a white heat. This fixity is occasioned by the acid carrying off the phlogiston of the arsenic, and thus leaving a greater proportion of its peculiar acid than what it naturally contains; and therefore the more frequently the operation is repeated, the more fixed the arsenic becomes, though it is scarce possible to dissipate the arsenical phlogiston as perfectly with this acid as with the nitrous; the effects of which have been already particularly mentioned.

1272 In marine acid. The marine acid, which naturally contains phlogiston, dissolves about one-third of its weight of arsenic, a great part of which separates spontaneously on cooling in a state of saturation with the acid. This salt, which may be had in a crystalline form, is much more volatile than the former, readily subliming in a close vessel with a moderate heat; but is soluble with difficulty in boiling water. It is of a fine yellow colour, and scarcely differs from butter of arsenic, except in its degree of concentration. The nature of marine acid prevents it from disengaging the arsenical acid from the phlogiston of the semimetal, as will easily appear from what has been said concerning that acid. The arsenical acid, however, is easily made to appear by the addition of that of nitre, as will be understood from the directions given by Mr Scheele for the preparation of the acid of arsenic.

1273 Phlogisticated alkali cannot precipitate arsenic except from marine acid. Arsenic is not precipitated from its solution in vitriolic and nitrous acids by the phlogisticated alkali, which yet very readily precipitates all other metals. From the marine acid, however, it is precipitated by its means of a white colour; but unless the solution be very acid, the addition of mere water will throw down a precipitate of the same colour.

1274 Decomposed by dephlogisticated marine acid. Dephlogisticated marine acid deprives arsenic of its inflammable principle; so that in the distilling vessel we find water, acid of arsenic, and marine acid, regenerated.

1275 Phenomena with other acids. Arsenic is dissolved by its own acid, and forms crystalline grains with it as well as with that of fluor and borax. Saccharine acid dissolves it likewise, and forms prismatic crystals; and a similar salt is also formed by the acid of tartar. Vinegar, and the acids of vinegar and phosphorus, form with it crystalline grains, which are scarcely soluble in water.

1276 Liver of arsenic. Solutions of fixed alkali dissolve arsenic; and, when loaded with it, form a brown tenacious mass, called *liver of arsenic*. The arsenic is partly precipitated by mineral acids, though part of it gradually loses its phlogiston, and adheres more tenaciously. Solution made with volatile alkali seems to effect this decomposition more readily, as no precipitation is made by acids. Limpid solution of saline hepar, dropped into a solution of white arsenic, floats upon the surface in form of a grey stratum, which at length disturbs the whole liquor.

1277 Effects on metals. By the assistance of heat solutions of arsenic attack some of the metals, particularly copper, iron, and zinc; the solutions of the two last yielding crystals by evaporation. No alteration is made on these compounds by alkaline salts or by acids: volatile alkali does not discover the copper by changing the colour of the solution blue; nor does the phlogisticated alkali throw down any blue precipitate from the solution of iron. The reason of this is the superabundance of phlogiston in the solutions; for the arsenical acid takes up all metals: when united with copper, it shows a blue colour with volatile alkali; and when united with iron, it lets fall a Prussian blue in the usual way; but the quantity of phlogiston which converts the acid into white arsenic, prevents the appearance of these phenomena when the latter is made use of.

1278 Unites easily with sulphur. Arsenic, either in its calcined or reguline state, may be united with sulphur; in which case it appears either of a red or yellow colour, according to the quantity of sulphur with which it is united. These compounds are spontaneously produced by nature; both of them sometimes pellucid and crystalline; with this difference, however, that the yellow seems to affect a lamellated, and the red a crystalline, form.
1279 Realgar and orpiment. These are called *red and yellow orpiment*, or realgar and orpiment; the specific gravity of realgar being about 3.225; of orpiment, 5.315. Both of these sublime totally with a moderate heat, unless when they happen to be mixed with other substances. They readily unite with those metals which form an union with the arsenic and sulphur of which they are composed. Silver mineralized by fusion with orpiment, forms a substance similar to what is called the red ore of that metal. Iron, in conjunction with orpiment, assumes a white, polished, and metallic appearance, similar to that of the white or arsenical pyrites; and by various combinations of these substances with metals of different kinds, many of the natural metalline ores may be produced.

1280 Phenomena with nitrous acid. Nitre, when treated with mineralized arsenic, detonates

Arsenic.

tonates partly with the sulphur, and partly with the phlogiston of the arsenic; the alkaline basis of the salt either forming sal polychrest with the acid of the sulphur, or uniting with the alkali, and forming the neutral arsenical salt. By the addition of fixed alkali in proper quantity, either to orpiment or realgar, and then exposing the mixture to a subliming heat, nitre retains the sulphur, but lets go the greatest part of the arsenic; the hepatic mass, however, retains a small quantity of the latter; and if there is much alkali, scarce any of the arsenic arises.

1281
Butter of arsenic.

On distilling orpiment with twice or thrice it quantity of corrosive sublimate, two liquids arise which refuse to unite; and at length, on augmenting the heat, a cinnabar arises. A butter of arsenic is found at the bottom of the receiver, of a ferruginous brown colour, but pellucid: in the open air it first sends forth a copious fume of a white colour, and then gradually attracts the moisture of the atmosphere, by which it is

1282
Can scarce be made to unite with marine acid.

precipitated. It is remarkable that it unites so slowly with marine acid, that they seem to repel one another; nor can they be made to unite beyond a certain degree. By the affusion of distilled water, a white powder will be precipitated, which, though ever so well washed, retains some acidity; for a portion of butter of antimony is produced by distillation, as is likewise true of the pulvis algaroth. The smoke has a peculiar penetrating smell, somewhat similar to that of phlogisticated vitriolic acid, and lets fall white flowers.

1283
Oil of arsenic.

The liquor which swims above, and which, by chemical authors, has been compared to oil, is yellowish and pellucid, separating a white arsenical powder by the addition of water and spirit of wine. It is not affected by the stronger acids; but effervesces, and lets fall a precipitate, with alkalies. On keeping it with a cucurbit with a long neck unstopped, white flowers gradually concrete round the orifice, which are lax, and sometimes approaching to a crystalline form. And lastly, by spontaneous evaporation, pellucid crystals appear at the bottom of the liquor, which are soluble in water with great difficulty; but when dissolved, precipitate silver from nitrous acid, and let fall some arsenic on the addition of an alkali. When put into lime-water, a cloud slowly surrounds them: on being exposed to the fire, they totally sublime without any arsenical smell, without decrepitation, or losing their transparency; but if ignited phlogistic matter comes in contact with them, the arsenical smell instantly appears. No traces of mercury are to be found in this liquor by treating it either with alkali or copper; not the slightest precipitation is made by it on being dropped into a solution of terra ponderosa in the marine acid: from all which it appears, that this liquor is only a very dilute butter of arsenic, containing less of the mercury on account of the quantity of water it has. The butter contains the acid in its most concentrated state, and is therefore loaded with a larger quantity of arsenic: the former liquor will therefore be obtained in much larger quantity, by setting the mixture of corrosive sublimate and arsenic to stand a night in a cellar, or moistened with water, before it be subjected to distillation. As the common marine acid can dissolve only a determined quantity of the butter, it naturally follows, that what remains after complete saturation should totally refuse to mix. The acid, however, when too much diluted, precipitates the butter; but in proportion to its strength it dissolves a greater quantity.

1284
Arsenic mineralized by sulphur.

Arsenic mineralized by sulphur is not dissolved by water, but is affected by the different acids, according to the particular circumstances of each. Nitrous acid and aqua-regia act most powerfully; the former soon destroys the red colour of the realgar, and converts it into yellow orpiment; its primary action being to calcine the arsenic, without affecting the yellowness of the sulphur. It makes no change on the colour of orpiment. Aqua-regia, by long digestion, takes up the arsenic, and leaves the sulphur at the bottom; and hence we may find out the proportions of the two ingredients. Some dexterity, however, is necessary in performing this operation with accuracy; for if, on the one hand, the menstruum be too weak, part of the arsenic will remain undissolved; and if, on the other, it be too strong, part of the sulphur will be decomposed; for strong nitrous acid is capable of decomposing sulphur by long digestion, having a greater attraction for phlogiston than the vitriolic acid itself. The colour of the residuum ought to be grey; for as long as any yellow particles remain, it is a sign that some of the arsenic also remains. If any iron be present in the compound, it is all dissolved, by reason of the superior attraction of the acid for it, before any of the arsenic is taken up, unless it shall have been calcined either by the access of air and heat employed in the operation, or by the too great power of the menstruum.

1285
Pure regulus of arsenic, how prepared.

The pure regulus of arsenic may be obtained artificially from white arsenic, either by sublimation with oil, black flux, or other phlogistic materials; or by melting it with double its weight of soap and potashes; or lastly, by precipitation by means of some other metal, from orpiment or sandarack melted with sulphur and fixed alkali. By the first of these methods it is obtained in a crystalline form, octohedral, pyramidal, or even prismatic.

1286
Misspickel, a natural regulus of arsenic.

Mr Bergman mentions a natural regulus of arsenic, named *misspickel*, which along with some sulphur contains a large quantity of iron united with the regulus into a metallic compound; but tho' the iron sometimes amounts to $\frac{1}{4}$ or even $\frac{1}{3}$ of the whole, it nevertheless remains untouched by the magnet. When ignited, it sends forth an arsenical smell, and soon becomes obedient to the magnet, even though the operation be performed on a tile without any additional phlogiston; it melts easily in an open fire, and in close vessels the greater part of the regulus sublimes, leaving the iron at the bottom.

1287
Great volatility of this semimetal.

The pure regulus of arsenic is vastly more volatile than any other metal, and therefore cannot be melted. It begins to send forth a visible smoke in 180° of the Swedish thermometer, and is capable of inflammation; but in order to inflame it, it must be thrown into a vessel previously heated to a sufficient degree, otherwise it will be sublimed. The flame is of an obscure whitish blue, diffusing a white smoke and garlic smell. In close vessels it retains its metallic form, and may be sublimed of any figure we please.

1288
Effects of regulus of arsenic on other metals.

Regulus of arsenic unites with many of the metals, but destroys the malleability of those with which it enters into fusion. It renders those more easy of fusion which are melted with difficulty by themselves; but tin, the most easily fusible of all the metals, becomes

Arsenic.

comes more refractory by being united with arsenic. This metal acquires a permanent and shining whiteness by its union with regulus of arsenic, and is able to retain half its own weight of the arsenical metal. The other white metals become grey by fusion with this semimetal, platina only excepted. Gold fused in a close vessel with regulus of arsenic, scarcely takes up $\frac{1}{60}$ of its weight; silver $\frac{1}{4}$; lead $\frac{1}{6}$; copper $\frac{5}{6}$; and iron more than its own weight. The magnetic property of this last metal is destroyed by a large quantity of regulus, though the exact proportion which destroys it can scarcely be determined, as some of the iron is always taken up by the scoria; but according to Mr Bergman, less than an equal quantity is certainly sufficient. Bismuth retains $\frac{1}{17}$ of its weight; zinc $\frac{1}{5}$; regulus of antimony $\frac{1}{8}$; and manganese an equal quantity. Nickel and regulus of cobalt take up a large quantity; but how much cannot be determined, as it is next to impossible to procure any of those metals in a state of perfect purity. In a sufficient degree of heat, and by a triture of several hours, regulus of arsenic takes up about $\frac{1}{6}$ of its own weight of mercury, forming an amalgam of a grey colour.

1289 May be expelled by heat from all the metals with which it is united.

Regulus of arsenic, by reason of its volatility, may be expelled from all the metals with which it is united; but, in flying off, it generally carries along with it some of the metals with which it is united, gold and silver not excepted, if the degree of heat be great and very suddenly applied. Platina, however, perfectly resists the volatilization; and by reason of its refractory nature, even retains a portion of the arsenic.

1290 Effects of it upon alkaline salts and nitre.

This semimetal cannot be united by fusion with alkaline salts until the phlogiston is considerably diminished, and the regulus approaches to the nature of pure arsenical acid. By adding regulus therefore to nitre in fusion, a detonation ensues, the phlogiston of the former is totally destroyed, and the acid uniting with the alkali of the nitre forms a neutral arsenical salt, similar to that made with white arsenic and nitre. By distillation with dry acid of arsenic, the regulus sublimes before it can be acted upon by the acid; but when thrown into the acid in fusion, soon takes fire, and sends forth a white smoke: for the acid, being in this instance deprived of its phlogiston, separates that principle from the regulus, and unites with it in such quantity as to regenerate white arsenic; while on the other hand, the regulus, by this operation, is so far deprived of its phlogiston as to appear in the form of a calx.

1291 Decomposes corrosive sublimate.

By distillation with corrosive sublimate, a smoking butter, and small quantity of mercurius dulcis and running mercury, are procured; which happens in consequence of a double elective attraction; the regulus of arsenic yielding its phlogiston to the base of the corrosive sublimate, which being thus really calcined, reduces the former to perfect mercury, while the marine acid takes up the calx of arsenic. The regulus of arsenic readily unites with sulphur, and forms the same red and yellow compounds that have already been mentioned when speaking of white arsenic; it is soluble in hepar sulphuris, but may be precipitated by every other metal which can unite with the hepar.

1292 Converted into white arsenic by the vitriolic acid.

Regulus of arsenic is not affected by the vitriolic acid, unless when concentrated and assisted by heat. The inflammable part of the regulus which phlogisticates the acid flies off, so that the remainder assumes the nature of white arsenic, and exhibits the same properties with menstrua as any other metallic calx: the same holds good with nitrous acid, except that it attracts the phlogiston more vehemently. Marine acid has little or no effect except when boiling.

Cobalt.

1293 Effects of it on metallic solution.

Regulus of arsenic precipitates certain metals dissolved in acids, such as gold and platina, dissolved in aqua-regia, as well as silver and mercury in vitriolic and nitrous acids. Silver generally appears in beautiful polished spiculæ, like the arbor Dianæ; but if the arsenic be suffered to stand long in the nitrous solution but little diluted, the silver spiculæ are again dissolved, the arsenic in the mean time being dephlogisticated. Solutions of bismuth and antimony are scarcely rendered turbid. Iron may be separated from regulus of arsenic by digestion with marine acid, or with aqua-regia; neither of which will touch the arsenic, as long as any iron remains; but in order to succeed in this operation, subtile pulverisation is necessary as well as a just quantity and strength of the menstruum. Heat must also be carefully avoided. The regulus is also dissolved by hepar sulphuris and by fat oils, the latter forming with it a black mass like plaster.

## § 12. Cobalt.

Regulus of cobalt, or more properly pure cobalt itself (what we have under the name of *cobalt* being only a calx of the regulus), is a semimetal of a reddish white colour, close-grained, so as to be easily reducible to powder, about 7.7 of specific gravity, and forming itself into masses of a needle-like texture, placed upon one another. It is seldom or never found native, but almost always calcined and united with arsenic, the arsenical acid, sulphur, iron, &c. The zaffre used in commerce is an impure and grey calx of cobalt. When mixed with three times its weight of pulverised flints, and exposed to a strong fire, it melts into glass of a dark blue colour, called *smalt*, used in tinging other glasses, and in painting. With three times its weight of black flux, a small quantity of tallow and marine salt, it affords the semimetal known by the improper name of *regulus of cobalt;* but the reduction is very difficult. For this purpose a large quantity of flux must be made use of, and the crucible kept a considerable time in a white-red heat, that the matter may become very fluid, and that the scoria may be completely fused into a blue glass, at which period the cobalt sinks in the form of a button to the bottom.

1294 Zaffre, a calx of cobalt.

1295 Smalt, how produced.

1296 Regulus of cobalt difficult to reduce.

1297 Properties of cobalt when exposed to heat.

Cobalt melts in a strong red heat, is very fixed in the fire, and it is uncertain whether it can be volatilized in close vessels. When suffered to cool slowly, it crystallizes in needle-shaped prisms, placed one upon the other, and united in bundles, having a considerable resemblance to masses of basaltes separated from each other: in order to succeed in this crystallization, however, the cobalt must be melted in a crucible till it begins to boil, and, when the surface of the metal becomes fixed on being withdrawn from the fire, the vessel is then to be inclined; that which still remains fluid runs out, and the portion adhering to the lumps formed by the cooling of the surface is found covered with crystals.

1298 Calcines spontaneously in the air.

This semimetal, exposed to the atmosphere, becomes covered with a dull pellicle, and undergoes a spontaneous calcination; but it may easily be calcined in

Cobalt.

in any quantity by exposing it in powder in a shallow vessel, under the muffle of a cupelling furnace, and stirring it now and then to expose fresh surfaces to the air. After being kept red hot for some time, this powder loses its splendor, increases in weight, and becomes black, the calx being convertible, by a most violent heat, into a blue glass. By fusion it combines with vitrifiable earths, forming with them a beautiful bule glass extremely fixed in the fire; whence it is of the greatest use in enamel-painting, porcelain-painting, &c. The action of terra ponderosa, magnesia, and lime, on cobalt, is not known. Alkalies manifestly alter it; but in what respect is not known.

1299 Its calx forms a beautiful blue glass.

1300 Phenomena with vitriolic acid.

Cobalt dissolves in concentrated vitriolic acid, when assisted by a boiling heat; the acid evaporating almost entirely in the form of sulphureous gas. The residuum is then to be washed; a portion of it dissolves in the water, and communicates a greenish colour to it when warm, which changes to a rose colour when cold. M. Beaumé affirms, that by sufficiently evaporating the vitriolic solution of cobalt, two sorts of crystals are obtained; one white, small, and cubical; the other greenish, quadrangular, six lines in length, and four in breadth. These last he only considers as the true vitriol of cobalt; the former being produced by certain foreign matters united to it. The crystals most commonly obtained have the form of small needles, and may be decomposed by fire, leaving a calx of cobalt not reducible by itself. They may likewise be decomposed by all the alkalies, by terra ponderosa, magnesia, and lime. According to Fourcroy, 100 grains of cobalt, dissolved in the vitriolic acid, afford, by precipitation with pure mineral alkali, 140 grains of precipitate; by the same alkali aërated, 160 grains. Diluted vitriolic acid acts on zaffre, and dissolves a part, with which it forms the salt already described.

1301 With nitrous acid.

Nitrous acid acts upon the semimetal with that violence which is its general characteristic; and the solution, when nearly saturated, appears either of a rosy brown or bright green colour. By strong evaporation it yields a salt in small needles joined together; which is very deliquescent, boils upon hot coals without detonation, and leaves a calx of a deep red colour. It is decomposed by the same substances as the former, and by excess of alkali the precipitate disappears.

1302 With marine acid.

Muriatic acid, assisted by heat, dissolves cobalt in part, but has no effect upon it in the cold. It acts more strongly on zaffre, forming a solution of a reddish brown, which becomes green by being heated. By evaporation it yields a very deliquescent salt in small needles, which becomes green when heated, and is soon after decomposed. Aqua-regia dissolves the metal more easily than the marine acid, but less so than the nitrous. The solution has been long known as a *sympathetic Ink*.

1303 With the acid of borax.

Cobalt is not dissolved directly by the acid of borax; but when a solution of this salt is mixed with a solution of cobalt in any of the mineral acids, a double decomposition takes place; the alkaline basis of the borax uniting with the acid which held the cobalt in solution; and the calx, combining with the sedative salt, falls to the bottom in form of an insoluble precipitate.

This semimetal is calcined by being heated to ignition with nitre. One part of cobalt, and two or three of dry nitre, well powdered and mixed, when thrown into a red-hot crucible; produce small scintillations; a portion of the cobalt being converted into a calx of a red colour, more or less deep, and sometimes of a green. Sal ammoniac is not decomposed, by reason of the little attraction there is between the metal and muriatic acid. M. Bucquet, who made the experiment with great care, could not obtain a particle of volatile alkali. Sulphur does not unite with it but very difficultly, and the combination is promoted by liver of sulphur. Thus a kind of artificial one may be produced, the grain of which will be finer or closer, and its colour whiter or yellower, in proportion to the quantity of sulphur in the mixture. M. Beaumé observes, that this compound cannot be decomposed by acids, and that fire cannot destroy all the sulphur.

Nickel.

1304 With sal ammoniac.

1305 With sulphur.

## § 13. *Nickel.*

1306 Discovered by Mr Cronstedt.

This was first discovered to be a semimetal of a peculiar kind by Cronstedt, in the years 1751 and 1754, who procured it in the form of regulus from its ore, but without being able to reduce it to a sufficient degree of purity; which indeed has not yet been done by any chemist. M. Bergman has laboured most in this way, though even he has not reduced it to the purity of other metallic substances. His experiments were made with some regulus made by M. Cronstedt, and whose specific gravity was to that of water exactly as 7.421 to 1. His attempts to purify it were made,

### I. By Calcination and Scorification.

1307 Effects of calcination with a violent heat.

Nine ounces of powdered nickel were exposed for six hours, in several portions, to a most violent heat, under the dome of an assay furnace. Thus the arsenic was first dissipated with a fetid smell, after which the odour of sulphur became perceptible; after this a white smoke arose without any smell of garlic, and which, according to our author, arose probably from the more dephlogisticated part of the arsenic which now began to sublime. The heaps (we suppose after the matter had been poured out of the dishes, and yet retaining a great deal of heat), when hot, began to swell, and green vegetations arose from all the surface, resembling some kinds of moss, or the filiform lichen; a ferruginous ash-coloured powder remained at bottom; and 0.13 of the whole were dissipated during the operation. Half an ounce of this calx fused in a forge for four minutes, along with three times its weight of black flux, yielded a regulus reticulated on the surface; the areola of a hexangular figure, with very slender striæ, diverging from a centre, full of little tubercles; it weighed 0.73 of half an ounce; was obedient to the magnet; and, when scorified with borax, left a blackish glass.

By a second roasting the regulus again emitted a garlic smell; afterwards a visible fume without any smell, with vegetations as before. The roasted powder, reduced with black flux as before, still emitted a smell of arsenic; but on repeating the fusion with the calx and borax, nothing but some obscure signs of cobalt appeared. A third calcination seemed to have much dissipated the arsenic, as it now emitted but little of that kind of smell; the vegetations were also gone; and the matter had rather a ferruginous than a green

Nickel. green colour. Nearly the same phenomenon appeared after reduction in a fourth operation.

On performing the reduction with lime and borax, the regulus, when first melted, lost much of its ferruginous matter, which adhered to the black scoriæ; it soon acquired an hyacinthine colour, without any remarkable mixture of cobalt, was little obedient to the magnet, and its specific gravity was somewhat diminished, being now only 7.0828.

By a fifth calcination, gradually adding a quantity of powdered charcoal while the matter continued red hot, a prodigious quantity of arsenic, imperceptible before, flew off in the form of vapour; the arsenical acid being thus furnished with as much phlogiston as was necessary to make it rise in fume. The regulus was treated in this manner until no more arsenical smoke could be perceived; it was now of a lamellated and tenacious texture when reduced, but still diffused the arsenical odour on being removed from the fire. The roasting was therefore repeated a sixth time, and continued for ten hours; the addition of powdered charcoal continued to dissipate the arsenic in invisible vapours which yet were perceptible by the smell; the colour of the metallic calx was obscurely ferruginous, with a mixture of green scarcely visible. On reducing the regulus with equal parts of white flux, lime and borax, a semiductile regulus was obtained, highly magnetic, and soluble in nitrous acid, to which it communicates a deep green colour; a blackish mass remained, which afterwards become white, and when laid on a burning coal, flies off without any remarkable arsenical smell. The regulus being then six times fused with lime and borax, the scoriæ resembled the hyacinth in colour, and the metallic part was surrounded with a green calx. The regulus, as before, was magnetic and semi-malleable. Lastly, it was exposed for 14 hours to a very strong heat; when the powdered charcoal was added by degrees without any dissipation of arsenic or loss of weight; the colour of the roasted powder was ferruginous, with a very slight tinge of green. On reduction, a very small globe, still magnetic, was found among the scoriæ.

### II. By Sulphur.

1308 Effects of sulphur and borax.

Eight hundred parts of Cronstedt's regulus of nickel, fused with sulphur and a small quantity of borax, yielded a mineralized mass of a reddish yellow, whose weight amounted to 1700. On exposing one half of this to the fire, it began to grow black; on which the heat was augmented until vegetations appeared; the remaining calx weighed 652. Melting this part with borax, and the other which had not been exposed to the fire, a sulphurated regulus of a whitish yellow colour was obtained, weighing 1102. The same regulus, calcined for four hours, was first covered with vegetations, and then, on the addition of powdered charcoal, diffused an arsenical odour; the metallic calx was green, and weighed 1038. A whitish yellow regulus was obtained semiductile, highly magnetic, and extremely refractory, weighing 594. By fusion with sulphur a second time, it weighed 816; one half of which roasted to greenness, united by means of fire to the other half still sulphurated, weighed 509, and was almost deprived of its magnetic quality. A calcination of four hours, during which phlogiston was added, dissipated a considerable quantity of arsenic; the powder put on an ash-colour, somewhat greenish, was in weight 569; and by reduction yielded a regulus whose surface was red, and which, on breaking, appeared of a white ash-colour, very friable, and weighing 432; the specific gravity 7.173.

On mineralizing the regulus a third time with sulphur, adding charcoal as long as any vestige of arsenic remained, which required a violent calcination of 12 hours, the remaining powder was of an ash-green colour, and weighed 364; but the regulus obtained by means of a reduction effected by the most violent heat in a forge for three quarters of an hour, was so refractory that it only adhered imperfectly to the scoria, which were of a distinct hyacinthine colour; nor could it be reduced to a globule by means of borax, though urged by the same vehemence of fire. The absolute gravity of this regulus was 180; its specific gravity 8.666. Its magnetic virtue was very remarkable; for it not only adhered strongly to the magnet, but to any other piece of iron; and the small pieces of it attracted one another. It had a considerable ductility, was of a whitish colour, mixed with a kind of glittering red; dissolved in volatile alkali, yielding a blue solution, and a green one in nitrous acid.

An hundred parts of the same regulus, beaten out into thin plates, were covered by a calcination of four hours, with a crust apparently martial, having under it a green powder, and within it a nucleus consisting of reguline particles still unchanged; the weight being increased by 5. The friable matter, reduced to powder, put on a brownish-green colour; and after a calcination of four hours more, concreted at the bottom in form of a friable black crust, strongly magnetic, and weighing 100: No vestiges of arsenic were discovered by a succeeding operation, in which charcoal was added; nor was the magnetic powder destroyed, but the weight was increased to 105, and the colour somewhat changed. By fusion for an hour with lime and borax, this powder yielded a regulus of an angular structure, red, semiductile, and altogether magnetic; the specific gravity being 8.875. The same globule dissolved in aqua-regia, was precipitated by green vitriol, as if it had been loaded with gold; but the precipitate was readily soluble in nitrous acid. Most of the reguli showed no signs of precipitation with green vitriol.

### III. With Hepar Sulphuris.

Fifty-eight parts of regulus of nickel, which had been sulphurated before, being fused with 1800 parts of saline hepar sulphuris, then dissolved in warm water, filtered through paper, and precipitated by an acid, yielded a powder, which, by calcination till the sulphur was driven off, appeared of an ash-colour, and weighed 35. The insoluble residuum, deprived of its sulphur by means of fire, was likewise of an ash-colour, and weighed 334. On reducing this regulus by means of the black flux, a friable regulus was obtained, which had a very weak magnetic property; but, on fusion with borax, this quality was augmented. On mixing and melting together equal parts of calx of nickel, gypsum, colophony, and white flux, a powdery, squamous, and reguline mass was produced; which, by fusion with borax, afforded a regulus possessing the properties 1309 Effect of hepar sulphuris.

perties of nickel, but not entirely deſtitute of cobalt, which obeyed the magnet, and did not part with its iron even after two ſolutions in the nitrous acid, and various reductions by fuſion with borax; the ſulphur was alſo retained with great obſtinacy.

On diſſolving regulus of nickel by fuſion, in hepar ſulphuris made with fixed alkali, adding a quantity of nitre ſufficient only to deſtroy a ſmall part of the hepar, the regulus which had been ſuſpended by it was ſeparated, and fell to the bottom. On examining this regulus, it appeared more pure, and generally deprived of cobalt, but ſtill containing iron. In like manner nickel is always very diſtinctly precipitated by regulus of cobalt, as this latter is attracted more powerfully by the hepar ſulphuris. When diſſolved by fuſion with hepar ſulphuris, this ſemimetal may be precipitated by adding iron, copper, tin, or lead, and even by cobalt: the regulus obtained is indeed ſcarcely ever attracted by the magnet; but we are not from thence to conclude that it does not contain any iron; for when the heterogenous matters, which impede its action, are properly removed, it then acknowledges the power of the magnet very plainly.

### IV. By Nitre.

1310 Of nitre.

One part of Cronſtedt's regulus was added to twelve of nitre ignited in a crucible, and kept red-hot for about an hour. Some weak flaſhes appeared firſt; then a large quantity of arſenic was emitted; and, laſtly, the ſides were covered with a blue cruſt occaſioned by the cobalt, a green matter remaining at bottom. This, fuſed again for an hour, with twelve parts of nitre, tinged the internal ſides of the veſſel of a green colour; and, laſtly, a browniſh green maſs, much leſs in quantity than in the former operation, was left at the bottom. This green matter, treated in the ſame way for two hours a third time, left a grey ſcoria at the bottom, which yielded no regulus with black flux.

Another portion of the ſame regulus, treated in the ſame way with nitre, was diſſolved, and became green; yet on being freed by ablution from the alkaline ſalt, it yielded no regulus with black flux, but only ſcoria of an hyacinthine colour mixed with blue, tinging nitrous acid of a green colour, concreting into a jelly, and on evaporation leaving a greeniſh calx behind.

Another portion of Cronſtedt's regulus was kept ſome hours in the crucible with 16 parts of nitre; by which means all the arſenic was firſt ſeparated; then the phlogiſticated nitrous acid; and, laſtly, the ſides of the veſſel were penetrated by a kind of green efflo reſcences. The maſs, after being waſhed with water, was of a dilute green colour, and tinged borax of a greeniſh brown. A green powder was ſtill yielded, after treating this in the ſame manner with 12 parts of nitre; and on reducing it with one-half black flux, one-eighth borax, and as much lime, a yellowiſh white regulus, both magnetic and malleable, was obtained, poſſeſſing all the properties of nickel. Its ſpecific gravity was 9.000; the phlogiſtic ingredient was uſed in ſmall quantity, that the iron might, if poſſible, enter the ſcoria.

1311 Nitre capable of ſeparating all the cobalt from nickel.

It having appeared from this and ſome other experiments, that nitre was capable of diſcovering the ſmalleſt quantity of cobalt contained in nickel the products of the former operations were now ſubjected to its action. The regulus produced by repeated ſcorification thus became a little blue; that diſſolved in volatile alkali (to be afterwards particularly mentioned) diſcovered a conſiderable quantity of cobalt; nor was there any one which did not thus diſcover more or leſs of that ingredient by this trial.

### V. By Sal Ammoniac.

1312 Effect of ſal ammoniac

A calx of nickel, ſo much freed from cobalt that it did not tinge borax in the leaſt, mixed with twice its weight of ſal ammoniac, yielded by ſublimation with a ſtrong red heat, two kinds of flowers; one, which roſe higher than the other, was of an aſh colour; the other white. The botton of the glaſs was ſtained of a deep hyacinthine colour; the reſiduum was divided into two ſtrata; the upper one yellow, ſcaly, and ſhining like moſaic gold. With borax it afforded an hyacinthine glaſs, but not regulus; and in a few days liquefied in the air, acquiring a green colour and the conſiſtence of butter. The reſiduum ſhowed the ſame properties with calx of nickel; and the green ſolution ſhowed no veſtiges of iron with galls, but became blue with volatile alkali; which was alſo the caſe with the flowers. The lower ſtratum contained a calx, blackiſh on the upper part, but of a ferruginous brown in the under, with a friable and ſcarcely magnetic regulus, of a reddiſh white. The blackiſh calx yielded an hyacinthine glaſs with borax. Part of this ſtratum ſublimed with twice its quantity of ſal ammoniac; and with the ſame degree of heat as before, yielded flowers of a very fine white, with a reſiduum of ferruginous brown, greeniſh on the upper part towards the ſides of the veſſel, the bottom being ſtained of an hyacinthine colour as before. Twenty parts of ſal ammoniac being added to a part of the inferior ſtratum reduced, the whole was ſublimed in a retort; a blackiſh powder remained, which became green by calcination, and of an hyacinthine colour by ſcorification, as did alſo the bottom of the containing veſſel. The ſublimation being twice repeated, uſing a double quantity of ſal ammoniac each time, the calx became at length very green, diſſolving with the ſame colour in the nitrous acid, and yielding by reduction a white, brittle, and very little magnetic regulus. In all theſe ſublimations, it was obſerved, that the volatile alkali roſe firſt; then ſal ammoniac; and, laſtly, a part of the marine acid was forced over by the violence of the heat.

### VI. With Nitrous acid.

1313 Effects of antimony.

Having obtained a ſalt by cryſtallization from nickel diſſolved in nitrous acid, part of this was calcined with charcoal duſt in a proper veſſel, and during the operation a large quantity of arſenic was diſſipated; a grey, ſemiductile, and magnetic regulus being obtained after reduction. A brittle regulus was obtained after a ſecond ſolution, precipitation, and reduction; but by a third operation it became again ſemiductile and magnetic. By repeating this proceſs a fourth and fifth time, the quantity became ſo much diminiſhed that it could no longer be tried. In all theſe ſolutions a blackiſh reſiduum appeared; which, when ſuffered to remain in the acid, grew white by degrees; but when edulcorated and laid on a burning coal, exhaled a ſulphureous ſmoke, and left a black powder ſoluble in the nitrous acid.

### VII. By volatile Alkali.

1314 Volatile alkali. Four hundred and eighty-seven parts of a calx of nickel, produced by dissolving Cronstedt's regulus in nitrous acid, and precipitating the solution by a fixed alkali, being immersed for 24 hours in a quantity of volatile alkali, yielded a residuum of fifty, having a blackish green colour. The solution, which was blue, by filtration and inspissation yielded a powder of a light blue colour, weighing 282; which, reduced with black flux, produced a white, semiductile, and highly magnetic regulus, weighing 35, whose specific gravity was 7.000. The scoriæ were of a light red: but when mixed with borax, put on an hyacinthine colour, and yielded a regulus weighing 30. The two reguli united together proved very refractory; so that the mass could not be melted by the blow-pipe, even with the addition of borax. It sent forth neither an arsenical nor sulphureous smell on the addition of charcoal-dust; but, on a succeeding reduction, yielded hyacinthine scoriæ; and the remaining flocculi, dissolved in nitrous acid, affording a very green solution, which, on the addition of volatile alkali, yielded a powder of the same colour.

From 50 parts of the blackish-green residuum, 13 of a clear white, brittle, squamous, and little magnetic regulus, were obtained, the specific gravity of which was 9.333. At the bottom of the vessel was found a scoria of an obscurely blue colour, with the upper part hyacinthine. It was easily fused; and tinged borax, first blue, then of a hyacinth colour, upon which it became more strongly magnetic. By the assistance of heat it dissolved in nitrous acid, forming a solution of a beautiful blue colour. A black powder at first floated in the liquor, but became white, and fell to the bottom. After edulcoration it was for the most part dissipated, with a sulphureous smell, on being exposed to the fire; a little brown-coloured mass, soluble in volatile alkali, remaining at bottom. This solution was precipitated by phlogisticated alkali, and a powder thrown down of the colour of calx of nickel, which soon grew blue with volatile alkali.

1315 Nickel cannot be obtained in a state of purity. From all these experiments it appears, that nickel cannot be obtained in a state of purity by any means hitherto known. From every other substance, indeed, it may be separated, except iron; but this resists all the operations hitherto described, and cannot be diminished beyond certain limits. The magnet not only readily discovers its presence, but some portions of the regulus itself becomes magnetic; but the tenacity and difficulty of fusion, which increase the more in proportion to the number of operations, plainly show that there is no hope of separating the whole quantity, unless we suppose the regulus of nickel itself to be attracted by the magnet; and there is certainly a possibility that one other substance besides iron may be attracted by the magnet. The great difficulty, or rather impossibility, of obtaining it in a state of purity,

1316 Bergman's opinion of the composition of nickel. naturally raises a suspicion of its not being a distinct semimetal, but a mixture of others blended together; and on this subject our author agrees in opinion with those who suppose it to be a compound of other metals. Indeed, Mr Bergman is of opinion, that "nickel, cobalt, and manganese, are perhaps no other than modifications of iron." And in order to ascertain this, he made the following experiments.

1317 Experiments to compose nickel artificially. 1. Equal parts of copper, of the gravity of 9.3243, and iron of 8.3678, united by fusion with black flux, yielded a red mass, whose specific gravity was 8.5441; and which tinged nitrous acid first blue, then green, afterwards yellow, and at last of an opaque brown. 2. Two parts of copper and one of iron had a specific gravity of 8.4634; the mixture yielding first a blue, and then a green solution. 3. Equal parts of copper and iron, of the specific gravities already mentioned, with another part of cobalt whose gravity was 8.1500, yielded a metal of the gravity of 8.0300, imparting a brown colour to the solution. 4. Two parts of arsenic of 4.000, added to one of copper and another of iron, gave a brittle metal of 8.0468, which formed a blue solution. 5. One part of copper, one of iron, two of cobalt, and two of white arsenic, gave a brittle regulus of 8.4186; the solution of which was brownish, and separated in part spontaneously. 6. One part of copper, one of iron, four of cobalt, and two of white arsenic, formed a mass of 8.5714. The solution was somewhat more red than the former; and a similar effect took place on repeating the experiment, only that the specific gravity of the metal was now 8.2941. 8. One part of iron and four of white arsenic formed a metal which dissolved with a yellow colour; and, on the addition of Prussian alkali, immediately let fall a blue sediment. 9. One part of copper, eight of iron, sixteen of white arsenic, and four of sulphur, united by fire, on the addition of black flux, yielded a mass which, though frequently calcined and reduced, produced nothing but brown or ferruginous calces. It acquired a greenness with nitrous acid; but on the addition of phlogisticated alkali deposited a Prussian blue. 10. One part of iron was dissolved in six of the nitrous acid, and likewise separated by one part of copper and one of the calcined ore of cobalt, in the same quantity of the same acid. The whole of the solution of iron was then mixed with five parts of the solution of copper, whence a green and saturated nickel colour was produced; which, however, on the addition of three parts of the solution of cobalt, became evidently obscured. The alkaline lixivium dropped into this threw down at first a ferruginous brown sediment, the solution still remaining green: afterwards all the blue was precipitated; by which at first all colour was destroyed, but afterwards a red appeared, occasioned by the cobalt dissolved in the alkaline salt. The sediment, when reduced, yielded a regulus similar to copper, and at the same time ductile, which tinged both glass and nitrous acid of a blue colour. If a saturated solution of nickel be mixed with half its quantity of solution of cobalt, the green colour is much obscured; but four parts of the former, on the addition of three of the latter, put off all appearances of nickel. See the article Nickel.

## § 14. *Of Platina.*

1318 The heaviest of all metals. The properties of this metal have not as yet been thoroughly investigated by chemists, and there is therefore some disagreement concerning them. Formerly it was supposed to be inferior in specific gravity to gold;

Platina.

gold; but now is generally allowed to be ſuperior in that reſpect by little leſs than a fourth part; being to water in the proportion of 23 to 1 when perfectly freed from all heterogeneous matters. Mr Bergman ſays that its colour is that of the pureſt ſilver. The very ſmall globules of it are extremely malleable; but when many of theſe are collected together, they can ſcarcely be ſo perfectly fuſed as to preſerve the ſame degree of malleability.

1319 Inſoluble except by dephlogiſticated marine acid.

They are not affected by the magnet in the leaſt, nor can they be diſſolved in any ſimple menſtruum excepting dephlogiſticated marine acid. As it is commonly met with, however, platina has the form of ſmall grains, its plates of a bluiſh black, whoſe colour is intermediate betwixt thoſe of ſilver and iron.

1320 Found in ſmall grains intermixed with foreign ſubſtances.

Theſe grains are mixed with many foreign ſubſtances, as particles of gold, mercury, and blackiſh ferruginous, ſandy grains, which by the magnifier appear ſcorified. The grains themſelves, when examined by a magnifying glaſs, appear ſometimes regular, ſometimes round and flat, like a kind of button. When beat on the anvil, moſt of them are flattened and appear ductile; ſome break in pieces, and on being narrowly examined appear to be hollow, and particles of iron and a white powder have been found within them: and to theſe we muſt attribute the attraction of platina by the magnet; ſince, as we have already obſerved, pure platina is not attracted by it.

1321 Mr Bergman's experiments on this metal.

Mr Bergman, who carefully examined this metal, diſſolved it firſt in aqua-regia compoſed of the nitrous and marine acid. The ſolution at firſt exhibits a yellow colour, but on approaching to ſaturation became red, and the redneſs increaſes as the liquor becomes more loaded with metal. Cryſtals are produced by evaporation of a deep red colour, generally in ſmall angular and irregular grains, whoſe true ſhape cannot be diſcovered. Their appearance is ſometimes oqaque and ſometimes pellucid. After theſe are once formed, they are extremely difficult of ſolution, requiring much more water than even gypſum itſelf for this purpoſe.—The ſolution is not precipitated by vegetable fixed alkali, nor does the latter affect the cryſtals, except very faintly by digeſtion with them in a cauſtic ſtate. Aerated mineral alkali takes them up and grows yellow, but without depoſiting any thing, though it decompoſes them at laſt by evaporating to dryneſs.

1322 Cryſtals of platina may be decompoſed by mineral but not vegetable fixed alkali.

On the addition of a ſmall quantity of vegetable fixed alkali, either mild or cauſtic, ſmall red cryſtals ſoluble in water, and ſometimes of an octohedral figure, are depoſited. They are decompoſed with difficulty by the mineral alkali, but not at all by the vegetable. If a larger quantity of ſalt is added at firſt, an inſoluble ſpongy matter of a yellow colour is precipitated. Cryſtalline particles of the ſame kind are thrown down by an alkali ſaturated either with the vitriolic, nitrous, marine, or acetous acids, though all the platina cannot thus be ſeparated from the menſtruum.

1323 Solution in aqua-regia made with nitrous acid and that of ſea-ſalt.

Aqua-regia, compoſed of nitrous acid and common ſalt, diſſolved the metal with equal facility as the former; only the ſolution was more dilute, and a yellow powder floated on the ſurface, a larger quantity being found at the bottom. On adding vegetable fixed alkali to the clear ſolution, a copious yellow powder, ſoluble in a large quantity of water, was depoſited. A powder, of a ſimilar kind, was precipitated, tho' more ſlowly, and more of a cryſtalline nature; but mineral alkali, though uſed in much larger quantity, did not make any alteration. The collected powder was yellow, and agreed in property with that ſeparated ſpontaneouſly in a former experiment.

1324 In a liquor compoſed of nitre and ſpirit of ſalt.

On repeating the experiment with nitre and depurated ſpirit of ſalt, inſtead of nitrous acid and ſea-ſalt, the platina was diſſolved into gold-coloured liquor, a greeniſh coloured granulated matter falling to the bottom, and the finer part of the ſame riſing to the top. After ſaturating the ſuperfluous acid, a metallic calx, inſoluble in water, was thrown down by the vegetable alkali. The green powder is ſoluble in water, and is of the ſame nature with the precipitate thrown down by the vegetable alkali.

1325 Cryſtalline powder precipitated by vegetable alkali from ſolution of the calx in marine acid;

1326 But not from the ſolution in nitrous acid.

Platina precipitated from aqua-regia by a ſufficient quantity of mineral alkali, the precipitate waſhed and diſſolved in marine acid, on the addition of vegetable alkali immediately lets fall a cryſtalline powder, as it does alſo with nitre and other ſalts, having the vegetable alkali for their baſis. The caſe is the ſame with calx of platina, diſſolved in vitriolic acid. Nitrous acid alſo diſſolves the calx of platina, but does not yield any diſtinct ſaline precipitate without the aſſiſtance of marine acid.—The above phenomena are likewiſe produced by the precipitate thrown down by the vegetable alkali after the ſaline powder has been depoſited.

1327 This precipitate a kind of triple ſalt.

From theſe experiments our author concludes, 1. That the precipitate which is firſt thrown down, on the addition of vegetable alkali to ſolutions of platina, is a ſaline ſubſtance, and different from the calx of the metal. 2. That this ſaline precipitate is compoſed of calcined platina, marine acid, and vegetable alkali. 3. By means of vitriolic acid, a precipitate analogous to this may be obtained, compoſed of calcined platina, vegetable alkali, and vitriolic acid. 4. The whole ſolution of platina cannot be precipitated by vegetable alkali in form of a triple ſalt; but after paſſing a certain limit, a metallic calx in the uſual way is produced.

1328 Whether mineral alkali can ſeparate platina from its ſolvent.

As it has been denied by Margraaf and Lewis that mineral alkali is capable of ſeparating platina from its acid, our author was induced to attend particularly to this circumſtance. Having therefore tried the common ſolution with mineral alkali, he found that each drop excited a violent efferveſcence, and at laſt that a yellow ſpongy matter, affording a genuine calx of platina, was precipitated: this was more ſpeedily effected by uſing the dry mineral alkali, which had fallen to powder of itſelf. To determine, however, the difference betwixt the two alkalies in a more accurate manner, he divided a very acid ſolution of platina into two equal parts. To one of theſe, he added ſmall portions of the vegetable, and to the other an equal weight of pieces of mineral alkali, waiting five minutes after every addition, till the efferveſcence ſhould fully ceaſe. After the firſt addition, ſmall cryſtals appeared; in the former partly on the ſurface, and partly in the bottom; but in the latter no precipitate could be obſerved until 56 times the quantity of vegetable alkali had been added. The difference, however, was even greater than what appears from this experiment; for the vegetable alkali was cryſtallized, and therefore charged with the water neceſſary to its cryſtalline form;

1329 Fifty-ſix times as much mineral alkali required to precipitate platina as of vegetable alkali.

Platina.

form; whereas the mineral alkali was spontaneously calcined: and though, in equal quantities of these two alkalies, the purely alkaline parts are as 3 to 2, yet three parts of vegetable alkali saturated only 1.71 of this aqua-regia, while two of the mineral alkali took up about 2.6.

1330 Effects of the volatile alkali.

The volatile alkali first throws down this metal in a saline form; the grains sometimes distinctly octohedral. Their colour is red when that of the solution is so, but yellow when the solution is more dilute. After saturating the superabundant acid, the same alkali precipitates the platina truly calcined. This precipitate is dissolved in water, though with difficulty, and may be reduced to more regular crystals by evaporation. These are dissolved by the mineral alkali; but hardly any signs of decomposition are to be observed, unless the yellow solution, evaporated to dryness, be again dissolved in water; for then the metallic calx rests at the bottom, and the solution is deprived of its yellow colour. The vegetable alkali has scare any effect in this way; for, after repeated exsiccation, the solution remains clear and yellow: but here probably the fixed alkali takes the place of the volatile; for in larger quantities, and especially when the caustic vegetable alkali is made use of, the mixture smells of volatile alkali.

1331 Platina partly precipitated by neutral salts.

The volatile alkali, saturated with any acid, precipitates the platina in the same manner as the vegetable alkali in combination with acids: but these neutral salts precipitate only a determined quantity of platina; for after their effect has ceased, the liquor lets fall a pure calx of platina on the addition of vegetable or volatile alkali.

1332 Triple salts formed by this metal.

The calx of platina precipitated by mineral alkali, and then dissolved in any simple acid, shows nearly the same phenomena with volatile alkali as with the vegetable alkali. "Whence (says Mr Bergman) we may conclude, that platina dissolved in acids forms at first, both with the volatile and fixed vegetable alkali, a triple salt, difficult of solution, and which therefore almost always falls to the bottom unless the quantity of water be very large." Calcareous earth, whether aerated or caustic, produces the same phenomena as the mineral alkali, without any crystalline appearance.

1333 Platina the most infusible substance in the world.

Platina has been remarkable ever since its first discovery for being the most infusible substance in the world. Messrs Macquer and Beaumé kept it in the most violent heat of a glass-house furnace for several days without perceiving any other alteration than that its grains adhered slightly to each other; but the adhesion was so slight that they separated even by touching. In these experiments the colour of the platina became brilliant by a white heat, but acquired a dull grey colour after it had been heated for a long time. They observed also, that its weight was constantly increased; which undoubtedly arose from the calcination of the iron it contained. Dr Lewis, after various attempts to fuse platina, found himself unable to succeed even in a fire which vitrified bits of glass-house pots and Hessian crucibles. Messrs Macquer and Beaumé first melted this refractory metal with a large burning-glass, 22 inches diameter and 28 inches focus. The power of this speculum was almost incredible, and far exceeded what is related of the lens of Tschirnhausen or the mirror of Villette. Its general effects are related under the article *Burning-Glass*. And as platina resisted this intense heat more than six times as long as the most unfusible substances formerly known, it appears to require a fire as many times stronger to melt it. It has been found, however, capable not only of fusion but of vitrification by the electric fire; and that it may also be melted by fire excited by dephlogisticated air: but M. de Lisle was the first who was able to melt it with the heat of a common forge when exposed to the blast of a double bellows in a double crucible. Thus its real specific gravity began first to be known. It must be observed, however, that this fusion was not performed on common platina, but on such as had been dissolved in aqua-regia and precipitated by means of sal ammoniac. M. Morveau repeated the experiment, and from 72 grains of platina obtained a regulus weighing $50\frac{1}{7}$; which seemed to have undergone a very imperfect fusion; for it did not adhere to the crucible or take its form, but seemed to be merely platina revived. Its specific gravity was also found to be no more than 10.045; but it was nearly as malleable as silver; and when it had been sufficiently hammered, its specific gravity was augmented to no less than 20.170, which is more than that of gold itself. M. Morveau found that he could melt the precipitate with different fluxes, such as a mixture of white glass, borax, and charcoal, and a mixture of white glass and neutral arsenical salt: and that the regulus thus obtained was more completely fused, but was not malleable, and obeyed the magnet; but the regulus obtained without addition did not show this mark of containing iron. He also found, that by means of the abovementioned flux of white glass, borax, and charcoal, he could melt crude platina. Since that time the fusion of platina has been accomplished by various chemists, and with different fluxes; and in proportion to the degree of purity to which the metal has been reduced, its specific gravity has also increased; so that it is now settled at 23, that of fine gold being 19.

1334 First melted by a burning mirror.

1335 May be vitrified by electric fire.

1336 Its precipitate fusible in a common forge.

1337 This precipitate, or even crude platina, fusible by the assistance of fluxes.

1338 Alloyed by Dr Lewis with other metals.

Though Dr Lewis could not accomplish the fusion of platina by the methods he attempted, he was nevertheless able to alloy it with other metals. Equal parts of gold and platina may be melted together by a violent fire, and the mixed metal formed into an ingot by pouring it into a mould. It is whitish, hard, and may be broken by a violent blow; but when carefully annealed, is capable of considerable extension under the hammer. Four parts of gold with one of platina form a compound much more fusible than the former, and likewise more malleable; so that it may be extended into very thin plates without being broken or even split at the edges. Dr Lewis remarks also, that though in this case it be alloyed with such a quantity of white metal, it nevertheless appears no paler than guineas usually are, which contain only one-twelfth of silver.

1339 With gold.

1340 With silver.

Equal parts of silver and platina melted together with a violent fire, form a much harder and darker-coloured mass than silver, which has also a large grain, though it preserves some ductility. Seven parts of silver with one of platina form a compound much more resembling silver than the other; but still coarser-grained and less white. From the experiments made on silver, however, it appears that no perfect union is formed

formed betwixt the two; for after the mixture has been kept in fuſion for a conſiderable time, moſt of the platina ſeparates and falls to the bottom. Lewis obſerved that ſilver melted with platina was thrown up with an exploſion againſt the ſides of the crucible.

Silver did not appear to be in any degree meliorated by its union with this metal, excepting by the ſuperior

1341 Copper conſiderably improved by union with platina.

hardneſs communicated to it; but copper ſeemed to be conſiderably improved. A large proportion of platina, indeed, as two-thirds or equal parts, produced an hard, brittle, and coarſe-grained compound; but when a ſmaller quantity of platina is added, as from $\frac{1}{6}$ to $\frac{1}{25}$, or even leſs, a golden-coloured copper is produced, very malleable, harder, ſuſceptible of a finer poliſh, ſmoother-grained, and much leſs ſubject to calcination and ruſt than pure copper.

1342 Unites moſt readily with zinc;

Of all metallic matters, however, zinc moſt readily unites with platina, and is moſt effectually diſſolved by fuſion. When the proportion of platina is conſiderable, the metal is of a bluiſh colour, the grain cloſer, without tarniſhing or changing colour in the air, and they have not even the malleability of the ſemimetal.

1343 And with the compound metals.

Platina unites readily with the compound metals, braſs formed of copper and zinc, and bronze made of copper and tin. In the latter it was remarkable, that the compound metal took up more platina than both its ingredients ſeparately can do. This compound was hard and capable of receiving a fine poliſh, but is ſubject to tarniſh.

1344 The compound of braſs and platina a proper material for ſpeculums.

Equal parts of braſs and platina formed a compound very hard, brittle, capable of receiving a fine poliſh, and not ſubject to tarniſh. It is poſſible therefore that it might be uſed to advantage as a material for ſpeculums; all materials for which, hitherto diſcovered, have the great inconvenience of tarniſhing in the air, and that very quickly.

1345 Can ſcarce be united with mercury.

Platina amalgamates with mercury, but with much greater difficulty than gold, which will alſo ſeparate the quickſilver after it has been united with the platina. The amalgamation of platina does not ſucceed but by very long trituration of the metals with water,

1346 Mercury leaves platina to unite with gold.

as for inſtance a week; but if the trituration be performed with a mixed metal compoſed of gold and platina, the mercury ſeizes the gold, and leaves the platina untouched. Dr Lewis propoſes this as a method of ſeparating gold from platina; and it is that uſed in Peru, where gold and platina are ſometimes naturally mixed in the ore; but we do not know whether this ſeparation be quite complete.

1347 May be united with forged and caſt iron;

Mr Morveau ſucceeded in uniting iron with platina, though Dr Lewis could not accompliſh this. The latter ſucceeded, however, in uniting it with caſt iron. The compound was much harder and leſs ſubject to ruſt than pure iron. It was alſo ſuſceptible of a much finer poliſh.

1348 And with tin, lead, or biſmuth.

Platina may be alloyed with tin, lead, or biſmuth, but without any advantage. To lead and tin it gives the property of aſſuming blue, violet, or purple colours, by being expoſed to the atmoſphere.

1349 May be melted by means of arſenic.

Dr Lewis could not ſucceed in uniting platina with arſenic; but M. Scheffer affirms, that if only one twentieth of arſenic be added to platina when red hot in a crucible, the two ſubſtances will be perfectly fuſed and united into a brittle grey maſs. This experiment did not ſucceed with Mr Margraaf; for he, having expoſed to a violent fire during an hour a mixture of an ounce of platina with a fuſible glaſs, compoſed of eight ounces of minium, two ounces of flints, and one ounce of white arſenic, obtained a regulus of platina well united and fuſed, weighing an ounce and 32 grains; the ſurface of which was ſmooth, white, and ſhining, and the internal parts grey; but which nevertheleſs appeared ſufficiently white when filed. The experiment ſucceeded imperfectly alſo in the hands of Dr Lewis; but M. Fourcroy informs us, that "it has ſince been repeated, and that platina is in fact very fuſible with arſenic, but that it remains brittle. In proportion as the arſenic is driven off by the continuance of the heat, the metal becomes more ductile; and by this proceſs it is that M. Achard and M. de Morveau ſucceeded in making crucibles of platina by melting it a ſecond time in moulds." (A)

1350 Fourcroy denies that platina can be united with mercury.

M. Fourcroy ſeems to deny that platina can be united with mercury, contrary to what is mentioned above. "Platina (ſays he) does not unite with mercury, though triturated for ſeveral hours with that metallic fluid. It is likewiſe known, that platina reſiſts the mercury uſed in America to ſeparate the gold. Many intermediums, ſuch as water, uſed by Lewis and Beaumé, and aqua-regia by Scheffer, have not been found to facilitate the union of theſe two metals. In this reſpect platina ſeems to reſemble iron, to whoſe colour and hardneſs it likewiſe in ſome meaſure approaches." This laſt ſentence, however, ſeems very little to agree with what he himſelf had before told us

1351 Inconſiſtent in his account of its hardneſs.

of M. Macquer's experiment of melting platina. "The melted portions (ſays he) were of a white brilliant colour, in the form of a button; they could be *cut to pieces* with a knife." This ſurely was a very ſmall approach to the hardneſs of iron; and gives us an idea rather of the conſiſtence of tin or lead. "One of theſe maſſes was flattened on the anvil, and converted into a thin plate without cracking or breaking, but it became hard under the hammer." In another experiment indeed the button of platina was brittle, and ſufficiently hard to make deep traces in gold, copper, and even iron; but this was obtained from precipitated platina urged for 35 minutes by a ſtrong blaſt furnace.

1352 Precipitated platina vitrified by M. Beaumé

In an experiment of this kind M. Beaumé even ſucceeded in melting the precipitate along with certain fluxes, into a vitriform ſubſtance by two different proceſſes. The precipitate of platina, mixed with calcined borax, and a very fuſible white glaſs, was expoſed, for 36 hours, in the hotteſt part of a potter's furnace; and afforded a greeniſh glaſs, inclining to yellow, without globules of reduced metal. This glaſs, treated a ſecond time with cream of tartar, gypſum, and vegetable alkali, was completely melted, and exhibited globules of platina diſperſed through its ſubſtance. M. Beaumé ſeparated them by waſhing, and found them ductile. The ſame chemiſt afterwards, together

(A) For a particular account of this proceſs ſee before n° 587.

gether with M. Macquer, exposed precipitate of platina to the same burning mirror with which they had fused the metal: the precipitate exhaled a very thick and luminous fume, with a strong smell of aqua-regia: it lost its red colour, resumed that of platina, and melted into a perfect brilliant button, which was found to be an opaque vitreous substance, of an hyacinthine colour at its surface, and blackish within; and may be considered as a true glass of platina. It may however be observed, that the saline matters with which it was impregnated contributed doubtless to its vitrification.

"The orange-coloured precipitate obtained by pouring a solution of sal ammoniac into a solution of platina, appears to be a saline substance entirely soluble in water. This precipitate has a valuable property, discovered by M. de l'Isle, viz. that it is fusible without addition in a good furnace or common forge-heat. The platina melted by this process is a brilliant, dense, and close-grained button; but it is not malleable unless it has been exposed to a very strong heat. Macquer thinks that this fusion, like that of the grains of platina alone, exposed to the action of a violent fire, consists only in the agglutination of the softened particles; which being exceedingly more divided and minute than the grains of platina, adhere to and touch each other in a greater number of points than the grains; and in that manner render the texture of the metal much more dense, though no true fusion may have taken place. It seems, however, that if platina in grains be capable of fusion by the burning-glass, and of becoming considerably ductile, the precipitate of this metal, formed by sal ammoniac may likewise be fused on account of its extreme division; and that its not being as ductile as the button of platina fused by the solar heat, may perhaps depend on its retaining a part of the matter it carried down with it in precipitation, of which it may be possible to deprive it by fire."

1353 Precipitate by sal ammoniac fusible in a strong forge heat.

1354 This fusion supposed by Macquer not to be perfect.

1355 Attempts to purify platina by cupellation

It being so extremely difficult to bring platina itself into fusion, one of the first attempts to purify it was by cupellation with lead. Thus the baser metals would be scorified; and, running through the crucible along with the lead, leave the platina in as great purity as though it had been melted by itself. This operation, however, was found almost equally difficult with the fusion of the metal by itself. Lewis failed in the experiment, though he applied the most violent heat of the ordinary cupelling furnaces. The vitrification and absorption of the lead indeed took place as usual; but in a short time the platina became fixed, and could not by any means be rendered fluid. Messrs Macquer and Beaumé succeeded by exposing an ounce of platina with two ounces of lead in the hottest part of a porcelain furnace, where the fire is continued for 50 hours without intermission. At the end of the operation the platina was flattened in the cupel; its upper surface was dull and rough, and easily separated; but its under surface was brilliant, and it was found easily to extend under the hammer; and on every chemical trial was found to be perfectly pure, without any mixture of lead. M. de Morveau likewise succeeded in cupelling a mixture of one drachm of platina and two drachms of lead in M. Macquer's wind-furnace. The operation lasted eleven or twelve hours, and a button of platina was obtained which did not adhere to the cupel, was uniform, though rather rough, and of a colour resembling tin. It weighed exactly one drachm, and was not at all acted upon by the magnet. Thus it appears that platina may be obtained in plates or laminæ, which may be forged, and consequently may be employed in making very valuable utensils; and this the more especially as Mr Beaumé has observed that different pieces of it may be welded and forged like iron. After having heated two pieces of pure cupelled platina to whiteness, he placed them one upon the other, and striking them briskly with a hammer, found that they united together as quickly and firmly as two pieces of iron would have done.

1356 Of the possibility of adulterating gold with platina.

The great specific gravity of platina has rendered it a very desirable matter for such as wish to adulterate the precious metal, and can procure the platina easily. This, however, can only be done in South America, where platina is met with in plenty. In Europe the scarcity of platina renders it a more valuable object than even the gold itself. Fears of this fraud, however, have undoubtedly given occasion to the prohibition of exporting it. There are great differences among chemists concerning the quantity of platina that can be mixed with gold without destroying the colour of the latter. Dr Lewis, as has already been observed, informs us, that four parts of platina may be mixed with one of gold, and yet the mixture be no paler than that for guineas; while Fourcroy asserts, that "it greatly alters the colour of the metal, unless its quantity be very small: thus, for example, a 47th part of platina, and all the proportions below that, do not greatly affect the colour of the gold." But whether this be the case or not, chemistry has afforded various ways of separating even the smallest proportion of platina from gold; so that there is now no reason to prohibit the importation of it to Europe, more than that of any other metal with which gold can be alloyed. The following are the methods by which the platina may be most readily discovered: 1. By amalgamating the suspected metal with mercury, and grinding the mixture for a considerable time with water; by which the platina will be left, and the gold remain united with the quicksilver. 2. By dissolving a little of it in aqua-regia, and precipitating with alkaline salt; the remaining liquor, in case the metal has been adulterated with platina, will be so yellow, that it is supposed a mixture of one thousandth part would thus be found out. 3. By precipitation with sal ammoniac, which throws down the platina but not the gold. If mineral alkali be used, the gold will be precipitated, but not the platina, unless the precipitant is in very large quantity. 4. By precipitation with green vitriol, which throws down the gold, and leaves the platina united with the menstruum.

1357 Methods of detecting this fraud if it should be practised.

1358 Platina most easily discoverable by its great specific gravity.

All these methods, however, are not only attended with a considerable deal of trouble, but in some cases, for instance in suspected coin, it might not be eligible to use them. The hydrostatic balance alone affords a certain method of discovering mixtures of metals without hurting the texture of their parts. The great specific gravity of platina would very readily discover it if mixed with gold in any moderate quantity; and even in the smallest, the gravity of the mass could never be less than that of the purest gold: which circumstance

cumſtance alone, as gold is never worked without alloy, would be ſufficient to create a juſt ſuſpicion; after which ſome of the methods already mentioned might be tried. It is poſſible, however, that the hardneſs and ductility of platina might render it more proper for alloying gold than even copper or ſilver, uſually made uſe of for this purpoſe.

## § 15. *Of Manganese.*

1359 New ſemimetal afforded by manganeſe.

THIS ſubſtance is now diſcovered to afford a ſemimetal different from all others, and likewiſe to poſſeſs ſome other properties of a very ſingular kind. Mr Scheele has inveſtigated its nature with the utmoſt care; and the reſult of his inquiries are as follows:

1360 Properties of the common manganeſe treated with vitriolic acid.

1. Two drachms of levigated manganeſe, digeſted for ſeveral days in a diluted vitriolic acid, did not appear to be diſſolved or diminiſhed in quantity; nevertheleſs a yellowiſh white precipitate was procured by ſaturating the acid with fixed alkali. The remaining manganeſe was not acted upon by more of the ſame acid, but the addition of another half ounce nearly deſtroyed the acidity of the menſtruum when boiled upon it.

2. With concentrated vitriolic acid an ounce of manganeſe was reduced to a maſs like honey, and then expoſed to the fire in a retort till it became red-hot. Some vitriolic acid came over into the receiver; and after breaking the retort, a maſs was found in it weighing 12¼ drachms, hard and white in the inſide, but red on the outſide. A great part of it diſſolved in diſtilled water, on the affuſion of which at firſt it became very hot. The reſiduum after edulcoration weighed a drachm and an half, and was of a grey colour. Being calcined in a crucible with concentrated vitriolic acid till no more vapours aroſe, it was all diſſolved by water excepting one drachm; which being again calcined with the ſame acid, an inſoluble reſiduum of a white colour, and weighing only half a drachm, remained. This white reſiduum effervesced with borax, and melted into a tranſparent brown glaſs; it likewiſe effervesced with fixed alkali, changing into a brown maſs, which yielded an hepatic ſmell with acids, and became at the ſame time gelatinous. The ſolution obtained by calcination was evaporated and ſet to cryſtallize. A few ſmall cryſtals of ſelenite were firſt depoſited, and afterwards ſome very fine large cryſtals of an oblique parallelopiped form, whoſe number increaſed as long as there was any liquid left. They taſted like Epſom ſalt, and Mr Weſtfeld ſuppoſes them to be alum; but according to Mr Scheele, they have no other reſemblance to alum than that they contain the vitriolic acid.

1361 Entirely diſſolved by phlogiſticated vitriolic acid.

3. By phlogiſticated vitriolic acid the manganeſe was entirely diſſolved. To procure this acid in purity, Mr Scheele dipped ſome rags in a ſolution of alkali of tartar, and after ſaturating them with the fumes of burning brimſtone, put them into a retort, pouring on them ſome diſſolved acid of tartar, luting on a receiver which contained levigated manganeſe and water. After a warm digeſtion of only one day, the liquid of the receiver had become as clear as water, and a little fine powder, conſiſting principally of ſiliceous earth, fell to the bottom.

4. Two drachms of levigated manganeſe, digeſted for ſeveral days with an ounce of pure colourleſs acid of nitre, did not appear to have deprived the menſtruum of its acidity, or to have been affected by it in any degree. The liquor being diſtilled off, and the product of the diſtillation poured back on the reſiduum, a ſmall quantity of it was diſſolved. By a third diſtillation, and pouring back the liquor on the reſiduum, a complete ſolution was effected; and this quantity of acid appeared capable of diſſolving nine drachms of the powder.

1362 Precipitate and cryſtals obtained from the ſolution.

5. The ſolution of manganeſe thus ſaturated, was filtered and divided into two equal portions. Into one of theſe ſome drops of vitriolic acid were poured, by which a fine white powder was thrown down, which, however, did not ſettle to the bottom for ſome hours. It was ſoluble neither in boiling water nor in acids. The limpid ſolution, by evaporation, yielded ſome ſmall cryſtals of ſelenite or gypſum.

6. From the other half of this ſolution, after evaporation by a gentle heat, about ten grains of ſmall ſhining cryſtals of a bitter taſte were obtained. On pouring ſome drops of vitriolic acid into the ſolution inſpiſſated by gentle heat, no precipitation, excepting of a little ſelenite, enſued; but as ſoon as it was inſpiſſated to the conſiſtence of honey, ſome fine acicular cryſtals, verging towards the ſame centre, began to form, but grew ſoft, and deliqueſced in a few days after.

1363 Manganeſe diſſolved by phlogiſticated nitrous acid.

7. Phlogiſticated nitrous acid diſſolves manganeſe as readily as the phlogiſticated vitriolic. A little levigated manganeſe mixed with ſome water was put into a large receiver, to which a tubulated retort was luted. Some ounces of common nitrous acid were put into the retort, to which ſome iron-filings were added, taking care always to cloſe the orifice with a glaſs ſtopple. The phlogiſticated nitrous acid thus paſſed over into the receiver, and diſſolved the manganeſe in a few hours: the ſolution was as limpid as water, excepting only a little fine ſiliceous earth. Another white precipitate, ſimilar to that produced by adding vitriolic acid to the ſolution in pure nitrous acid now began to fall; but in other reſpects this ſolution agreed with the former.

1364 Effects of it on ſpirit of ſalt.

8. An ounce of purified muriatic acid was poured upon half an ounce of levigated manganeſe; which, after ſtanding about an hour, aſſumed a dark brown colour. A portion of it was digeſted with heat in an open glaſs veſſel, and ſmelled like warm aqua-regia. In a quarter of an hour the ſmell was gone, and the ſolution became clear and colourleſs. The reſt of the brown ſolution being digeſted, to ſee whether the muriatic acid would be ſaturated with manganeſe, an effervescence enſued, with a ſtrong ſmell of aqua-regia, which laſted till next day, when the ſolution was found to be ſaturated.

1365 Entirely diſſolved by this acid.

Another ounce of acid was poured upon the reſiduum, which was followed by the ſame phenomenon, and the manganeſe was entirely diſſolved, a ſmall quantity of ſiliceous earth only remaining. The ſolution, which was yellow, being now divided into two portions, ſome drops of vitriolic acid were poured into the one, by which it inſtantly became white, and a fine powder, inſoluble in water, was precipitated. Some ſmall cryſtals of ſelenite were formed by evaporation, and the reſiduum exhibited the ſame phenomenon with thoſe abovementioned with nitrous

Manganese trous acid, by evaporating the other half, some small shining angular crystals were obtained, similar to those procured by means of the nitrous acid.

1366 Scarce soluble in fluor acid, 9. Very little manganese was dissolved by fluor acid, even after several days digestion. A great quantity was required to form a saturated solution. It had very little taste, and gave a small quantity of precipitate with fixed alkali. But if a neutral salt, composed of fluor acid and sal ammoniac, be added, a double decomposition takes place, and the manganese is precipitated along with the fluor acid.

1367 Or in phosphoric acid. 10. A drachm of phosphoric acid, digested with as much powdered manganese, dissolved but little of it; and, though evaporated to dryness, the residuum tasted very acid; but by adding more manganese the acid was at last saturated. On adding microcosmic salt to a solution of manganese, a decomposition takes place similar to that effected by the combination of fluor acid and volatile alkali.

1368 Partly soluble in acid of tartar. 11. Pure acid of tartar dissolved manganese partly in the cold, and more effectually by means of heat. The whole, however, could not be dissolved, though the acid was at last saturated by adding a great quantity of the mineral. On adding a solution of soluble tartar, a double decomposition took place.

1369 With difficulty in the acetous. 12. Little was dissolved by distilled vinegar, though boiled on manganese; but after distilling spirit of verdigris several times upon it, the acid at last became saturated. The solution, evaporated to dryness, left a deliquescent mass. Little or none of the remaining manganese was dissolved by concentrated vinegar, though repeatedly distilled upon it.

1370 Entirely dissolved by acid of lemons; 13. With acid of lemons the whole was dissolved with effervescence, excepting only some white earth.

1371 And by water impregnated with fixed air. 14. Water impregnated with fixed air likewise dissolved manganese, but parted with it on the addition of alkali, or spontaneously by exposure to the air.

1372 Has a strong attraction for phlogiston. From these experiments Mr Scheele concludes, that manganese has a strong elective attraction for all phlogistic substances; and that this attraction becomes stronger, if there be present a menstruum which can unite with the phlogisticated manganese. Thus it attracts phlogiston more powerfully than even the nitrous acid itself in the moist way.

1373 Becomes white by saturation with phlogiston. By saturation with phlogiston, manganese has the property of losing its black colour, and assuming a white one, which is unusual, the phlogiston generally communicating a black or dark colour to the substances with which it was united.

1374 Contains some phlogiston naturally. That manganese naturally contains some phlogiston, though but in small quantity, appears from evaporating a solution of it in vitriolic acid to dryness, and then distilling the mass in a glass retort in an open fire. When the retort begins to melt, the acid parts fly off from the manganese in a sulphureous state, leaving the former of its natural black colour. By distilling the mass remaining after evaporation of the nitrous solution, a green volatile nitrous acid remains, and the black calx of manganese remains as before.

1375 Becomes insoluble in pure acids by losing its phlogiston. A solution of this mineral in vitriolic or nitrous acid, precipitated by fixed alkali, retains its colour; but when calcined in the open fire, again becomes black.

By losing its phlogiston, manganese becomes insoluble in pure acids; and therefore the residuum of the abovementioned distillations cannot be dissolved by adding more of the vitriolic or nitrous acids: but if that which has come over into the receiver be poured back into the retort, a solution will again take place by reason of the manganese reassuming the phlogiston it had parted with to the acid.

1376 Partial solutions of manganese explained on this principle. On this principle our author explains the reason of the partial solutions of this mineral abovementioned. Part of it is dissolved, for instance, in the vitriolic acid, while the remainder is found insoluble. This happens (says he), "because the undissolved portion has parted with the little phlogiston it naturally possessed to that portion of manganese which is taken up by the vitriolic acid during the first digestion; for without that principle it is insoluble."

Manganese attracts phlogiston more strongly when combined with some acid than by itself, as appears from the following experiments.

1377 Strong attraction of manganese when combined with acids for phlogiston. 1. Levigated manganese, digested or boiled with a solution of sugar, honey, gum arabic, hartshorn, jelly, &c. remains unchanged; but on mixing the pounded mineral with diluted vitriolic, or pure nitrous acid, and then adding some of these substances, the whole is dissolved, the black colour vanishes by degrees, and the solution becomes as limpid as water. So strong is the attraction of manganese for phlogiston in these circumstances, that metals, the noble ones not excepted, render it soluble in these acids in a limpid form.

1378 Why the concentrated acid of vitriol dissolves manganese without addition. Concentrated vitriolic acid, indeed, dissolves manganese entirely without any phlogiston. "It would be difficult (says Mr Scheele) to comprehend whence the phlogiston in this case should come, if we were not certain that several substances, which have a great attraction for phlogiston, can attract it in a red heat. Quicksilver and silver, when dissolved in the purest nitrous acid, really lose their phlogiston, which is a constituent part of these metals. This appears from the red vapours in which the acid arises; and the dissolved metallic earth cannot be again reduced to its metallic form, till it has acquired the lost phlogiston, which is effected either by precipitation with complete metals or by heat alone. Thus manganese can attract the quantity of phlogiston necessary for its solution by means of concentrated vitriolic acid from heat. It is not probable that the concentrated acid undergoes a decomposition in this degree of fire; for if you saturate half an ounce of this acid with alkali of tartar, and afterwards calcine in a retort, with a receiver applied, an ounce and a half of powdered manganese, with an equal quantity of the same vitriolic acid, then dissolve the calcined mass in distilled water, and likewise wash well the receiver, which contains some drops of vitriolic acid, which are also to be added to the solution, and lastly, add the same quantity of alkali, there will be no mark of superabundant acid or alkali. Thence it may be concluded, that the phlogiston in the vitriolic acid, if there really exists any in it, contributes nothing to the solution. But the manganese precipitated by alkali, contains a considerable quantity of it; in consequence of which it is afterwards entirely soluble in acids without any addition.

1379 Why the volatile sulphureous acid dissolves it. "The effects of volatile sulphureous acid on manganese, clearly prove what has been asserted. The manganese attracts the phlogiston contained in this acid, which is the cause of its great volatility, and which renders

Manganese renders the former soluble in the new pure vitriolic acid. If this solution be mixed with concentrated vitriolic acid and distilled, no volatile sulphureous acid is obtained; and if it be precipitated by means of fixed vegetable alkali, vitriolated tartar is obtained; which proves that manganese has a stronger attraction than vitriolic acid for phlogiston in the moist way.

1380 Effects of nitrous acid on manganese explained.

"The effects of nitrous acid on this substance are similar to those of vitriolic acid. Could spirit of nitre sustain as great a degree of heat as the concentrated vitriolic acid, it would also entirely dissolve the manganese by means of the phlogiston attracted by heat; but as this is not the case, it is necessary to add phlogiston in the manner abovementioned. The manganese decomposes phlogisticated nitrous acid, for the same reason that it does the volatile sulphureous acid; and that the phlogiston of this acid really combines with manganese, is manifest from this, that the affusion of vegetable acid produces no smell of aquafortis by displacing the phlogisticated acid of nitre. By distillation with pure vitriolic acid also, the nitrous acid is expelled, not in a smoking state, and of a yellow colour, but pure and colourless.

"In the solution of manganese by means of gum arabic or sugar, a very considerable effervescence takes place, owing to the extrication, or probably rather the production, of fixed air from the mixture; but with phlogisticated acid of nitre no such phenomenon takes place, because the manganese is combined with pure phlogiston; and if this should be again separated, there is no cause for the production of fixed air. This mineral is also dissolved without effervescence, by uniting it with nitrous acid and metals, arsenic or oil of turpentine."

1381 Existence of phlogiston in the muriatic acid proved

As muriatic acid dissolves manganese without addition, Mr Scheele is of opinion that this proves the existence of phlogiston in that acid, as has already been taken notice of. The manganese digested in the cold with spirit of salt assumes a dark brown colour; for it is a property of this substance that it cannot be dissolved into a colourless liquor without phlogiston, but has always a red or blue colour; but with spirit of salt the solution is more brown than red, on account of the fine particles of the manganese floating in the liquid. Here the mineral adheres but loosely to the acid, so that it may be precipitated by water.

1382 Explanation of the action of acid of tartar and acid of lemons.

The effects of acid of tartar and acid of lemons upon manganese are likewise explained on the principle already laid down, *viz.* the extreme attraction this substance has for phlogiston. Thus it attracts part of that naturally contained in these acids, decomposing one part of them, and being dissolved by the other. This destruction of the acid is similar to that of the sugar, gum arabic, &c. which render it soluble in nitrous acid; for if a proper quantity of these are added, the manganese will be dissolved, without a possibility of recovering the smallest particle of the vegetable substance employed; and if the solution be slowly evaporated and calcined, there will not remain the smallest mark of burned sugar or gum. During this decomposition, a pungent vapour arises, which, being collected, appears to be true vinegar. It is obtained in its purest state from diluted vitriolic acid, sugar, and manganese.

1383 Of fluor acid.

Fluor acid dissolves but very little manganese, owing to its precipitating salt which envelopes the particles of manganese, and prevents the further action of the menstruum. In all precipitations of manganese, however, by means of mild fixed alkalies, the full quantity is not procured; because the fixed air, detached from the mineral, dissolves part of it.

1384 Effects of manganese on nitre.

Though manganese decompounds nitre, yet this does not happen till the mixture becomes red hot. If phlogisticated manganese be mixed with an equal quantity of nitre, and distilled in a glass retort, the mixture begins to grow black before the retort becomes red-hot, but no nitrous acid goes over. By lixiviation, no mark of uncombined alkali is met with; but phlogisticated nitrous acid is extricated by the application of tamarinds, or any vegetable acid. Three parts of phlogisticated manganese, mixed with one part of finely pounded nitre, yields no nitrous acid, though the nitre is alkalized as soon as the mixture becomes black in the retort.

1385 Experiments on manganese united with phlogiston.

Mr Scheele proceeds now to another set of experiments upon manganese united with phlogiston. In order to procure it in this state, the best method is to dissove in distilled water, and crystallize the salt obtained by solution of manganese in vitriolic acid, and then precipitate it with vegetable fixed alkali. In this state it is white like chalk: but by calcination in an open fire, the superfluous phlogiston flies off, and the calx regains its usual black colour. This change of colour likewise happens when the precipitation is made with caustic alkalies, whether fixed or volatile. The precipitate, indeed, in this case, is white when kept close from the air, but assumes a brown colour when exposed to it for any time: But when the precipitation is made by mild alkali, the white colour is preserved by the fixed air, which in this case it also contains. By diluting the solution with a considerable quantity of water, and precipitating with caustic alkali, the precipitate is brown from the very beginning, owing to the air in the liquid attracting the phlogiston from the manganese. The precipitate formed by lime-water is also brown; but on adding more of a strong solution of manganese, and afterwards precipitating with caustic alkali, the powder falls of a white colour; because the air, being already saturated with phlogiston, cannot take up any more. The results of Mr Scheele's experiments on this phlogisticated manganese are,

1386 By distillation *per se.*

1. An ounce of this substance distilled by itself in a glass retort, with a strong fire, yielded a great quantity of fixed air with some drops of water. The residuum poured warm out of the retort grew red-hot, and set the paper on fire.

2. On repeating the experiment with only a drachm of phlogisticated manganese, and tying a bladder to the neck of a retort, three ounce-measures of air came over: the residuum was of a light grey colour; dissolved in acids without addition of any more phlogiston; and took fire in that degree of heat in which sulphur smokes, but does not burn. From these experiments, says Mr Scheele, it is evident, that phlogiston does not separate from manganese if the access of air be prevented.

1387 Boiled with oil olive.

3. One part of finely powdered manganese boiled in four of oil-olive, effervesced violently, and dissolved into a kind of salve.

1388 By distillation with charcoal.

4. On distilling a mixture of finely powdered manganese and charcoal, with an empty bladder tied to the mouth of the retort, a quantity of fixed air was extricated

Manganese. cated when the retort began to melt and distended the bladder. The residuum was mostly soluble in diluted vitriolic acid.

1389 With sulphur. 5. On distilling half an ounce of powdered manganese with two drachms of sulphur, the latter partly rose into the neck of the retort, and some volatile acid vapours penetrated through the lute. The distillation was continued till the retort began to melt; and, on cooling, the residuum was found to weigh 5½ drachms. It was of a yellowish-grey colour; and dissolved in spirit of vitriol with effervescence, yielded an hepatic smell, some sulphur being also precipitated at the same time. By calcination in the open air, the sulphur was dissipated; but great part of the mass was rendered soluble on account of its having been penetrated by the acid vapour, and shot into crystals as though it had been formally dissolved in volatile sulphureous acid; and by repeating the calcination with more sulphur, the whole became at last entirely soluble, and was reduced to crystals.

1390 By calcination with nitre. Finely powdered manganese, triturated with nitre and strongly calcined in a crucible, unites with the alkali of the nitre, while the acid is dissipated in the air. The mass formed by the union of the manganese and alkali is of a dark green colour, and soluble in water, communicating also a green colour to the liquid; but in a short time a fine yellow powder (an ochre of iron) falls to the bottom, leaving the liquor of a blue colour. By the addition of water, this solution first assumes a violet colour, grows afterwards red, and a precipitation of the manganese takes place, which resumes its natural colour as soon as it has fallen. The same precipitation takes place on the addition of a few drops of acid, or by exposure for some days to the open air. As for the dark red colour assumed by the solution when the precipitate is about to fall, Mr Scheele conjectures that the particles of manganese may naturally have a red colour, which becomes visible when the substance is dispersed through a menstruum without being perfectly dissolved.

1391 With the addition of arsenic. 7. By the addition of finely powdered white arsenic to the alkaline mass of nitre and manganese, the green colour disappears, and the whole becomes white; phlogisticated manganese being also precipitated on the addition of water. This arises from the more powerful attraction of manganese for the phlogiston of the arsenic than that of the arsenical acid itself; and for the same reason, if the mass be calcined with charcoal, or any other phlogistic substance, a colourless solution will be obtained.

1392 By distillation with sal ammoniac. 8. Half an ounce of phlogisticated manganese, distilled in a retort with an equal quantity of powdered sal ammoniac, yielded first a concrete volatile salt, after which some sal ammoniac undecomposed arose in the neck of the retort. Half an ounce of pure dephlogisticated manganese, mixed with two drachms of powdered sal ammoniac, yielded alkali in its caustic state. Both residuums were soluble in water; which shows that manganese attracts phlogiston from the volatile alkali.

1393 By distillation with pure nitrous acid. 9. On digesting finely powdered manganese for some weeks with pure nitrous acid and some volatile alkali, a great number of air-bubbles rise to the top, and the volatile alkali is entirely decomposed: for though the mixture be afterwards distilled in a retort with the addition of quicklime, not the least urinous smell can be perceived. This decomposition is effected by the manganese attracting the phlogiston of the volatile alkali; for that the nitrous acid has no share in this, is proved by the following experiment.

1394 Volatile alkali destroyed by manganese attracting its phlogiston. 10. An ounce of well triturated manganese was distilled with half an ounce of sal ammoniac; and a liquid alkali, such as that obtained from sal ammoniac and quicklime, was procured. On repeating this experiment, with the variation only of a bladder instead of a receiver, the same kind of air was obtained as that which rises to the top of the nitrous mixture. Though the emission of this air indicated a destruction of the volatile alkali, our author explains the reason of its being still obtained in a caustic state by the phlogiston taken from the alkali being more than sufficient to render the alkali soluble in muriatic acid; in consequence of which, the superfluous quantity combines with the manganese, and enables it to decompose the sal ammoniac in the ordinary way. It must be owned, however, that his reasoning on this subject is not entirely satisfactory, nor does the account he gives of his experiments seem entirely consistent with itself. See *Scheele's Chem. Essays*, Essay V. § xxxix.

1395 By distillation with arsenic. 11. Powdered manganese, distilled with an equal quantity of white arsenic, underwent no change, the arsenic flying off in its proper form; but with an equal quantity of yellow orpiment, some volatile sulphureous acid came over first, then a yellow sublimate, and at last a little red sublimate arose. On augmenting the fire by degrees, the orpiment remained obstinately attached to it. Similar effects ensued on treating manganese with an equal quantity of antimony; which likewise yielded a pungent sulphureous acid, but no sublimate. By calcination in the open air these compounds are decomposed; and the manganese, united with vitriolic acid, becomes soluble in water.

1396 With cinnabar. 12. On distilling manganese with an equal quantity of finely pounded cinnabar, a volatile sulphureous acid came over first; then a little cinnabar was sublimed into the neck of the retort; and at last the quicksilver, which had been the basis of the cinnabar, began to distil: the residuum, being a combination of manganese and sulphur, was similar to the compounds already described.

1397 With corrosive sublimate. 13. With an equal quantity of corrosive sublimate, manganese underwent no change; but when sublimed with an equal quantity of mercurius dulcis, a corrosive sublimate, and then mercurius dulcis, arose into the neck of the retort. The reason of this is, that the mercurius dulcis contains a portion of phlogiston; by being deprived of which it ceases to be mercurius dulcis, and becomes corrosive sublimate: but by reason of the strong attraction of manganese for phlogiston, the mercurius dulcis parts with that portion which is necessary to keep it in its mild state, and thus is converted into corrosive mercury.

## Sect. IV. *Inflammable Substances.*

1398 General division. These may be divided into the following classes: 1. Sulphurs. 2. Ardent spirits. 3. Oils and fats. 4. Resins. 6. Bitumens; and, 6. Charcoal.

Sulphur.

§ 1. *Sulphurs.*

1399 Sulphur. 1. *Common sulphur.* For the extraction of this substance from its ores, see Sulphur. The artificial composition of it we have already related, n° 715; and have now only to take notice of a very few of its properties, which come more properly under this section.

Sulphur, as commonly used in commerce and the arts, is of a pale yellow colour, of a disagreeable and peculiar smell, which is rendered more sensible when it is heated or rubbed. By rubbing, it receives very curious electrical qualities: (See Electricity.) Its specific gravity is considerably greater than that of water, though less than earths or stones. In close vessels, sulphur is incapable of receiving any alteration. It melts with a very gentle heat; and then is sublimed, adhering to the capital in small, very fine, needle-like crystals, called *flowers of sulphur*. It may thus be sublimed many times without alteration. If sulphur is exposed to a heat barely sufficient to melt it, and very slowly cooled, it crystallizes in form of many needles crossing one another. Some of these pointed crystals may also be observed in the interior parts of the lumps of sulphur which have been melted, and cast into cylyndrical moulds, as they are commonly sold; because the centre of these cylindrical rolls is more slowly cooled than the surface. Sulphur also gives this needle-like form to cinnabar, antimony, and many other minerals containing it. Sulphur may be decomposed in several ways. The most simple is by burning; which we have already taken notice of, n° 623. It may also be very effectually decomposed by mixing it with iron filings and water. In this case the phlogiston is dissipated, and the acid uniting with the iron forms a green vitriol.

1400 Crystallization.

1401 Decomposed by a superabundance of phlogiston.

It is very remarkable, that though sulphur is composed of vitriolic acid and phlogiston, yet the addition of more inflammable matter, so far from making the union stronger, weakens it to a great degree: and hence we have another method of decomposing this substance; namely, by combining it with a large quantity of oil, and distilling the compound.

Sulphur is capable of being easily dissolved in expressed oils, but very difficultly in essential ones. These compositions are called *balsams of sulphur;* and are sometimes employed in medicine, but are found to be of a very heating nature. They are much used by farriers. According to Mr Beaumé, sulphur cannot be dissolved in oil, without a heat sufficient to melt it. A larger quantity is kept dissolved when the mixture is hot, than when cold; and consequently the sulphur, especially if it has been dissolved in a thin essential oil, crystallizes on cooling the mixture. The sulphur, thus separated from the oil, is found not to be altered in any respect from what it formerly was; but if the mixture is exposed to a degree of heat capable of entirely decomposing the oil, the sulphur is decomposed along with it, and the same products are obtained by distilling this mixture to dryness, as if a mixture of pure oil of vitriol and oil were distilled. These products are, first a portion of oil, when an essential oil was made use of in the composition of the balsam; then some volatile sulphureous acid, which is at first watery, and afterwards becomes stronger; along with this acid more oil arises, which becomes more and more thick towards the end of the distillation; and lastly, when the retort has been made red hot, nothing remains but a fixed coal.

In this process we find, that both the sulphur and oil are decomposed. The acid of the sulphur seems to attack the watery principle of the oil, while its phlogiston remains confounded with that of the oil, or is dissipated in vapours. Hence, though the vitriolic acid in sulphur is concentrated to the utmost degree, and perfectly free from water, what rises in this distillation is very aqueous, by reason of the water which it attracts from the oil. 1402 How soluble in spirit of wine.

Spirit of wine does not sensibly act upon sulphur in its liquid state; but if both the spirit of wine and sulphur meet in the state of vapour, they will then unite, and a perfect solution will take place. By methods of this kind, many combinations might be effected, which have been hitherto thought impossible. 1403 Its union with metals.

Pure sulphur unites easily with all metals; gold, platina, and zinc, excepted. The compounds, except that with mercury, possess a metallic lustre without any ductility. The sulphur may be separated by exposing the mixture to a strong fire. (See Metallurgy,) or by dissolving the metalline part in acids. The sulphur, however, defends several of the metals from the action of acids; so that this dissolution succeeds but imperfectly. The reguline part of antimony is more easily separated from sulphur by means of acids than by any other metalline substance. Alkaline salts will separate the sulphur from all metals in fusion, but they unite with it themselves, and form a compound equally capable of dissolving the metal. 1404 Vermilion

Sulphur united with quicksilver forms the beautiful pigment called *cinnabar*, or *vermilion;* which is so much used in painting, that the making of it is become a distinct trade. Neumann relates, that in the making of cinnabar by the Dutch method, six or eight parts of quicksilver are made use of to one of sulphur. The sulphur is first melted, and then the quicksilver is stirred into it; upon which they unite into a black mass. In this part of the process the mixture is very apt to take fire; of which it gives notice by swelling up to a great degree. The vessel must then be immediately covered. The mass being beaten to powder, is afterwards to be sublimed in large earthen jars almost of an equal wideness from end to end; these are hung in a furnace by a strong rim of iron. When the matter is put in, the mouth of the vessel is covered, the fire increased by degrees, and continued for several hours, till all the cinnabar has sublimed; care being taken to introduce at times an iron rod to keep the middle clear; otherwise the cinnabar concreting there, and stopping up the passage would infallibly burst the vessels.

The quantity of sulphur directed in the common receipts for making cinnabar is greatly larger than the above; being no less than one-third of the quantity of quicksilver employed: accordingly it has been found, that the sublimate, with such a large quantity of sulphur, turned out of a blackish colour, and required to be several times sublimed before it became perfectly red; but we cannot help thinking, that by one gentle sublimation

Sulphur. ſublimation the ſuperfluous ſulphur might be ſeparated, and the cinnabar become perfectly pure the ſecond time. Hoffman gives a curious method of making cinnabar without ſublimation: by ſhaking or digeſting a little mercury with volatile tincture of ſulphur, the mercury readily imbibes the ſulphur from the volatile ſpirit, and forms with it a deep red powder, not inferior in colour to the cinnabar prepared in the common manner. Dr Lewis has found the common ſolutions of ſulphur by alkalies, or quicklime, to have a ſimilar effect. This cinnabar will likewiſe be of a darker or lighter colour, according as the ſolution contains more or leſs ſulphur.

1405 Pulvis fulminans. Sulphur is a principal ingredient in gun-powder, (ſee GUN-POWDER.) It alſo enters the compoſition of the *pulvis fulminans*. This conſiſts of three parts of nitre, two of the dry alkali of tartar, and one part of ſulphur, well ground together. If a little quantity of this powder is laid on an iron-ſpoon or ſhovel, and ſlowly heated, it will explode, when it arrives at a certain degree of heat, with aſtoniſhing violence and noiſe. The moſt probable opinion concerning this is, that the fixed air contained in the alkali is, by the acid vapours acting upon and endeavouring to expel it all at once, driven off with ſuch force, that a loud exploſion is produced.

1406 Phoſphorus of urine. 2. *Phoſphorus of Urine*. This is a very inflammable ſubſtance, compoſed of phlogiſton united with a certain acid, the properties of which we have already taken notice of, n° 904 *et ſeq*. The preparation of it was long a ſecret, and only perfectly diſcovered by Mr Margraaf, who publiſhed it in the Berlin Memoirs in 1743. This proceſs being by far the beſt and moſt practicable, we ſhall content ourſelves with inſerting it alone.

1407 Mr Margraaf's proceſs for making. Two pounds of ſal ammoniac are to be accurately mixed with four pounds of minium, and the mixture diſtilled in a glaſs retort; by which means a very penetrating, cauſtic alkaline ſpirit will be obtained. The reſiduum, after the diſtillation, is a kind of *plumbum corneum;* n° 812. This is to be mixed with nine or ten pounds of extract of urine, evaporated to the conſiſtence of honey. (Seventy or eighty gallons of urine are required to produce this quantity of extract.) The mixture is to be made ſlowly in an iron pot ſet over the fire, and the matter frequently ſtirred. Half a pound of powdered charcoal is then to be added, and the evaporation continued till the whole is reduced to a black powder. This powder is to be put into a retort, and urged with a graduated heat, till it becomes red hot, in order to expel all the volatile alkali, fetid oil, and ammoniacal ſalt, that may be contained in the mixture. After the diſtillation, a black friable reſiduum remains, from which the phoſphorus is to be extracted by a ſecond diſtillation and a ſtronger heat. Before it is ſubjected to another diſtillation, it may be tried by throwing ſome of it upon hot coals. If the matter has been well prepared, a ſmell of garlic exhales from it, and a blue phoſphorical flame is ſeen undulating along the ſurface of the coals.

The matter is to be put into a good earthen retort, capable of ſuſtaining a violent fire. Three quarters of the retort are to be filled with the matter which is to yield the phoſphorus, and it is to be placed in a furnace capable of giving a ſtrong heat. Mr Margraaf divides the matter among ſix retorts, ſo that if any accident happens to one, the whole matter is not loſt. The retorts ought to be well luted to a receiver of a moderate ſize, pierced with a ſmall hole, and half full of water; and a ſmall wall of bricks muſt be raiſed between the furnace and receiver, in order to guard this veſſel againſt heat as much as poſſible. The retorts are to be heated by ſlow degrees for an hour and an half; then the heat is to be increaſed till the veſſels are red hot, when the phoſphorus aſcends in luminous vapours. When the retort is heated till between a red and white, the phoſphorus paſſes in drops, which fall and congeal in the water at the bottom of the receiver. This degree of heat is to be continued till no more comes over. When a retort contains eight pints or more, this operation continues about five hours.

In the firſt diſtillation, phoſphorus never paſſes pure, 1408 Rectification of phoſphorus. but is always of a blackiſh colour, by reaſon of its carrying along with it ſome part of the coal. From this, however, it may be purified by rectification in a ſmall glaſs-retort, to which is luted a receiver half full of water. A very gentle heat is ſufficient; becauſe phoſphorus, once formed, is very volatile; and as the fuliginous matter was raiſed probably by the fixed air emitted by the charcoal in the inſtant of its union with the phoſphorine acid, none of it can ariſe in a ſecond diſtillation.

The phoſphorus is then to be divided into ſmall cylindrical rolls, which is done by putting it in glaſs-tubes immerſed in warm water; for the phoſphorus is almoſt as fuſible as ſuet. It takes the form of the glaſs-tubes; from which it may be taken out, when it is cold and hardened. This muſt be done under water, leaſt the phoſphorus ſhould take fire.

This concrete continually appears luminous in a dark 1409 Proceſs ſometimes dangerous. place; and by a very ſlight heat takes fire, and burns far more vehemently than any other known ſubſtance. Hence it is neceſſary to be very cautious in the diſtillation of it; for if the receiver ſhould happen to break while the phoſphorus is diſtilling, and a little flaming phoſphorus fall upon the operator's legs or hands, it would burn its way to the bone in leſs than three minutes. In this caſe, according to Mr Hellot, nothing but urine will ſtop its progreſs.

Though phoſphorus takes fire very readily by itſelf, it does not inflame at all by grinding it with other inflammable bodies, as camphor, gun-powder, or eſſential oils. In grinding it with nitre, ſome luminous flaſhes are obſerved; but the mixture never burns, unleſs the quantity of phoſphorus be large in proportion to the nitre: rubbed pretty hard on a piece of paper or linen, it ſets them on fire if they are rough, but not if they are ſmooth. It fires written paper more readily than ſuch as is white, probably from the former having more aſperities. On grinding with iron-filings, it preſently takes fire.

Oils ground with phoſphorus appear, like itſelf, 1410 Liquid phoſphorus. luminous in a temperately warm place; and thus become a liquid phoſphorus, which may be rubbed on the hands, &c. without danger. Liquid phoſphorus is commonly prepared by grinding a little of the ſolid phoſphorus with oil of cloves, or rubbing it firſt with camphor, and this mixture with the oil. A luminous *amalgam*, as it is called, may be obtained, by digeſting

 a ſcrua ſcruple of ſolid phoſphorus with half an ounce of oil of lavender, and, when the phoſphorus begins to diſſolve and the liquor to boil, adding a drachm of pure quickſilver; then briſkly ſhaking the glaſs for five or ſix minutes till they unite.

1411 **Experiments on phoſphorus with ſpirit of wine.**

Rectified ſpirit of wine, digeſted on phoſphorus, extracts a part of it, ſo as to emit luminous flaſhes on being dropt into water. It is computed that one part of phoſphorus will communicate this property to 600,000 parts of ſpirit. The liquor is never obſerved to become luminous of itſelf, nor in any other circumſtance except that abovementioned. By digeſtion for ſome months, the undiſſolved phoſphorus is reduced to a tranſparent oil, which neither emits light nor concretes in the cold. By waſhing with water, it is in ſome meaſure revived; acquiring a thicker conſiſtence, and becoming again luminous, though in a leſs degree than at firſt. During this digeſtion, the glaſs is very apt to burſt.

1412 **With eſſential oils and acids.**

Phoſphorus is partially diſſolved by expreſſed oils; and totally, or almoſt ſo, in eſſential oils and ether. When eſſential oils are ſaturated with it by heat, a part of the phoſphorus ſeparates, on ſtanding in the cold, in a cryſtallize form. Concentrated ſpirit of ſalt has no action on it. In diſtillation, the ſpirit riſes firſt, and the phoſphorus after it unchanged. Spirit of nitre diſſolves it, and the diſſolution is attended with great heat and copious red fumes; ſo that great part of the ſpirit diſtils without the application of any external heat, and the phoſphorus at laſt takes fire, explodes, and burſts the veſſels. Oil of vitriol likewiſe diſſolves phoſphorus, but not without a heat ſufficient to make the acid diſtil. The diſtilled liquor is white, thick, and turbid; the reſiduum is a whitiſh tenacious maſs, which deliquates, but not totally, in the air. Phoſphorus itſelf is reſolved into an acid liquor on being expoſed two or three weeks to the air, its inflammable principle ſeeming by degrees to be diſſipated.

Phoſphorus has been reported to produce extraordinary effects in the reſolution of metallic bodies: but from the experiments that have been made with this view, it does not appear to have any remarkable action on them; at leaſt on the precious ones, gold and ſilver, for the reſolution or ſubtilization of which it has been chiefly recommended. The following experiments were made by Mr Margraaf.

1413 **Mr Margraf's experiments with metals.**

1. A ſcruple of filings of gold were digeſted with a drachm of phoſphorus for a month, and then committed to diſtillation. Part of the phoſphorus aroſe, and part remained above the gold, in appearance reſembling glaſs: this grew moiſt on the admiſſion of air, and diſſolved in water, leaving the gold unaltered. Half a drachm of fine ſilver, precipitated by copper, being digeſted with a drachm of phoſphorus for three hours, and the fire then increaſed to diſtillation, greateſt part of the phoſphorus aroſe pure, and the ſilver remained unchanged Copper filings being treated in the ſame manner, and with the ſame quantity of phoſphorus, the phoſphorus ſublimed as before; but the remaining copper was found to have loſt its metallic brightneſs, and to take fire on the contact of flame. Iron filings ſuffered no change. Tin filings run into granules, which appeared to be perfect tin. Filings of lead did the ſame. The red calx of mercury, called *precipitate per ſe*, treated in the ſame manner, was totally converted into running quickſilver. 2. Regulus of antimony ſuffered no change itſelf, but occaſioned a change in the conſiſtence of the phoſphorus; which, after being diſtilled from this ſemimetal, refuſed to congeal, and continued, under water, fluid like oil-olive. With biſmuth there was no alteration. A drachm of phoſphorus being diſtilled and cohobated with an equal quantity of zinc, greateſt part of the zinc ſublimed in form of very light pointed flowers of a reddiſh-yellow colour: theſe flowers, injected into a red hot crucible, took fire, and run into a glaſs reſembling that of borax. White arſenic, ſublimed with phoſphorus, aroſe along with it in form of a mixed red ſublimate. Sulphur readily unites with phoſphorus into a maſs which ſmells like *hepar ſulphuris*. This does not eaſily take fire on being rubbed; but expoſed to a moderate dry heat, it flames violently, and emits a ſtrong ſulphureous fume. If phoſphorus is burnt in an open veſſel, a quantity of acid remains behind; and if a glaſs bell is held over it, an acid likewiſe ſublimes in the form of white flowers.

1414 **Mr Canton's phoſphorus.**

3. *Mr Canton's phoſphorus.* This is a compoſition of quicklime and common ſulphur. The receipt for making it is as follows. "Calcine ſome common oyſter-ſhells, by keeping them in a good coal-fire for half an hour; let the pureſt part of the calx be pulverized and ſifted. Mix with three parts of this powder one part of flowers of ſulphur. Let this mixture be rammed into a crucible of about an inch and a half in depth till it be almoſt full; and let it be placed in the middle of the fire, where it muſt be kept red hot for an hour at leaſt, and then ſet by to cool: when cold, turn it out of the crucible; and cutting or breaking it to pieces, ſcrape off, upon trial, the brighteſt parts; which, if good phoſphorus, will be a white powder. This kind of phoſphorus ſhines on being expoſed to the light of the ſun, or on receiving an electrical ſtroke.

1415 **Homberg's phoſphorus or pyrophorus.**

4. *Phoſphorus of Homberg.* This ſubſtance, which has the ſingular property of kindling ſpontaneouſly when expoſed to the air, was accidentally diſcovered by Mr Homberg, as he was endeavouring to diſtil a clear flavourleſs oil from human excrements. Having mixed the excrement with alum, and diſtilled over as much as he could with a red heat, he was much ſurpriſed at ſeeing the matters left in the retort take fire upon being expoſed to the air, ſome days after the diſtillation was over. This induced him to repeat the operation, in which he met with the ſame ſucceſs; and he then publiſhed a proceſs, wherein he recommended alum and human excrement for the preparation of the phoſphorus. Since his time, however, the proceſs has been much improved; and it is diſcovered, that almoſt every vitriolic ſalt may be ſubſtituted for the alum, and moſt other inflammable ſubſtances for the excrement; but though alum is not abſolutely neceſſary for the ſucceſs, it is one of the vitriolic ſalts that ſucceed beſt. The following proceſs is recommended in the Chemical Dictionary.

1416 **Beſt method of preparing.**

Let three parts of alum and one of ſugar be mixed together. This mixture muſt be dried in an iron ſhovel, over a moderate fire, till it be almoſt reduced to a blackiſh powder or coal; during which time it muſt be ſtirred with an iron ſpatula. Any large maſſes muſt be bruised into powder; and then it must be put into a glass matrass, the mouth of which is rather strait than wide, and seven or eight inches long. This matrass is to be placed in a crucible, or other earthen vessel, large enough to contain the belly of the matrass, with about a space equal to that of a finger all round it. This space is to be filled with sand, so that the matrass shall not touch the earthen vessel. The apparatus is then to be put into a furnace, and the whole to be made red hot. The fire must be applied gradually, that any oily or fuliginous matter may be expelled; after which, when the matrass is made red hot, sulphureous vapours exhale: this degree of heat is to be continued till a truly sulphureous flame, which appears at the end of the operation, has been seen nearly a quarter of an hour: the fire is then to be extinguished, and the matrass left to cool, without taking it out of the crucible; when it ceases to be red hot, it must be stopped with a cork. Before the matrass is perfectly cold, it must be taken out of the crucible, and the powder it contains poured as quickly as possible into a very dry glass phial, with a glass stopper. If we would preserve this phosphorus a long time, the bottle containing it must be opened as seldom as possible. Sometimes it kindles while it is pouring into the glass phial; but it may be then extinguished by closing the phial expeditiously. A small quantity of this pyrophorus laid on paper, and exposed to the air, immediately takes fire, becomes red like burning coals, and emits a strong sulphureous vapour greatly resembling that which arises on decomposing liver of sulphur.

1417 Is not injured by mere exposure to light.

It has been generally alleged, that the common black phosphorus is impaired by being exposed to the light; but Mr Cavallo has discovered the fallacy of this supposition by the following experiment. Some portions of the same pyrophorus were inclosed in three glass tubes, and immediately sealed up hermetically. On the 22th of May 1779, two of them were suspended from a nail out of a window, and the third was wrapped up in paper and inclosed in a box, where not the least glimmering of light could enter. In this situation they were left for more than a year; after which one of those that had been kept out of the window was broke, along with that which had been kept in the dark, in the presence of Mr Kirwan; when the pyrophorus seemed to be equally good in each tube, taking fire in about half a minute after it was taken out of the tubes, and exposed to the air on a piece of paper.

1418 Cause of the accension.

There are many different kinds of pyrophori: some of the most remarkable of which are described under the article PYROPHORUS. Many theories have been invented to solve the phenomenon of their accension on the contact of air. This has been thought owing to the conversion of the earth of alum into lime, or to a remainder of the vitriolic acid attracting moisture from the atmosphere; but the formation of pyrophorus without either alum or vitriolic acid, shows that neither of these opinions can be just. It is more probable, therefore, that, the heat is occasioned by the total dissipation of that aqueous part which is essential to the constitution of terrestrial substances. In consequence of this, the water contained in the atmosphere is not only attracted with avidity, but decompounded by the matter reduced to such a state of extreme dryness. By these operations it gives out the latent heat contained in it, and this produces the accension in question.

## § 2. *Ardent Spirits.*

See FERMENTATION and DISTILLATION.

## § 3. *Oils.*

1419 Essential oils.

1. *Essential Oils.* Those oils are called *essential* which have evidently the smell of the vegetable from which they are drawn. For the method of procuring them, see DISTILLATION. They are distinguished from all others by their superior volatility, which is so great as to cause them rise with the heat of boiling water. All these have a strong aromatic smell, and an acrid, caustic taste; in which respect also they differ from other

1420 Supposed cause of their taste.

oils. This taste is thought to proceed from a copious and disengaged acid, with which they are all penetrated. The presence of this disengaged acid in essential oils, appears from the impression they make upon the corks of bottles in which they are kept. These corks are always stained of a yellow colour, and a little corroded, nearly as they are by nitrous acid. The vapour of these oils also reddens blue paper, and converts alkalies into neutral salts.

1421 Of their solubility in spirit of wine.

This acid is likewise supposed to be the cause of their solubility in spirit of wine. They are not all equally soluble in this menstruum, because they do not all contain an equal quantity of acid. As this acid is much disengaged, they lose a great deal of it by repeated distillations, and therefore they become less and less soluble on being frequently distilled. By evaporation they lose their most volatile and thin part, in which the specific smell of the vegetable from which they are extracted resides; by which loss they become thick, and acquire the smell and consistence of turpentine, and even of resins. In this state they are no longer volatile with the heat of boiling water; and, if distilled with a stronger fire, they give over an oil which has neither smell nor taste of the vegetable whence they were extracted, but is entirely empyreumatic, and similar to those oils procured by distilling vegetable or animal substances with a strong fire. See DISTILLATION.

1422 Camphor.

To the class of essential oils, the volatile concrete called *camphor* seems most properly to belong. With them it agrees in its properties of inflammability, solubility in spirit of wine, and a strong aromatic flavour. The only differences between them are, that camphor is always in a solid state, and is incapable of decomposition by any number of sublimations.

1423 Decomposed by distillation with bole.

It has, however, been found possible to decompose it by distillation with certain additions. By distilling it several times along with bole, we obtain a fluid having the properties of an essential oil, soluble in water, and separating again on the the addition of spirit of wine.

1424 With dephlogisticated nitrous acid.

On distilling it eight times with dephlogisticated nitrous acid, we obtain a salt having the form of a parallelopiped, of an acid and bitter taste, and changing the juice of violets and turnsole red. This has the properties of a true acid; combines with fixed and volatile alkalies into neutral salts capable of being crystallized; dissolves copper, iron, bismuth, arsenic and

cobalt.

Oils. cobalt. With magnesia it forms regular crystals, in some measure resembling basaltes. It is distinguished from the acid of sugar by not precipitating lime from its solution in marine acid, and by forming with magnesia a white powder soluble in water.

According to Neumann, all the camphor made use of is the produce of two species of trees; the one growing in Sumatra and Borneo, the other in Japan. Of these, the Japan kind is the only one brought into Europe. The tree is about the size of a large lime, the flowers white, and the fruit a small red berry. All parts of the tree are impregnated with camphor; but the roots contain most, and therefore are chiefly made use of for the preparation of this commodity: though, in want of them, the wood and leaves are sometimes mixed.

The camphor is extracted by distillation with water in large iron pots filled with earthen heads stuffed with straw; greatest part of the camphor concretes among the straw, but passes down into the receiver among the water. In this state it is found in small bits like gray salt-petre, or common bay-salt; and requires to be purified either by a second sublimation, or by dissolution in spirit of wine, filtration, and exsiccation. If the first method is followed, there will be some difficulty in giving it the form of a perfect transparent cake. A difficulty of this kind indeed always occurs in sublimations; and the only way is to keep the upper part of the glass to such a degree of heat as may keep the sublimate in a half-melted state. Dr Lewis recommends the depuration of camphor by spirit of wine, and then melting it into a cake in the bottom of a glass.

Camphor possesses considerable antisceptic virtues; and is a good diaphoretic, without heating the constitution; with which intention it is often used in medicine. It is likewise employed in fire-works and several other arts, particularly in making varnishes. See Varnish.

1425 Soluble in ardent spirits and oil. This substance dissolves easily and plentifully in vinous spirits and in oils; four ounces of spirit of wine will dissolve three of camphor. On distilling the mixture, the spirit rises first, very little camphor coming over with it. This shows that camphor, however volatile it may seem by its smell, is very far from having the volatility of ether, and consequently is improperly classed with substances of that kind.

1426 Empyreumatic oils. 2. *Empyreumatic Oils*. Under this name are comprehended all those oils, from whatever substance obtained, which require a greater heat for their distillation than that of boiling water. These are partially soluble in spirit of wine, and becomes more and more so by repeated distillations. The empyreumatic oils obtained from animal substances are at first more fetid than those procured from vegetables; but by repeated distillations, they become exceedingly attenuated and volatile, becoming almost as white, thin, and volatile, as ether. They then acquire a property of acting upon the brain and nervous system, and of allaying its irregular movements, which is common to them with all other inflammable matters when highly attenuated and very volatile; but this kind of oil is particularly recommended in epileptic and convulsive affections. It is given from 4 to 10 or 11 drops: but, though prepared with the utmost care, it is very susceptible of losing its whiteness, and even its thinness, by a short exposure to air; which proceeds from the almost instantaneous evaporation of its more thin and volatile parts, and from the property which the less volatile remainder has of acquiring colour. To avoid this inconvenience, it must be put, as soon as it is made, into very clean glass bottles with glass stoppers, and exposed to the air as little as possible. Oils.

The most important observations concerning the method of making the pure animal oils are, first to change the vessel at each distillation, or at least to make them perfectly clean; for a very small quantity of the thicker and less volatile part is sufficient to spoil a large quantity of that which is more rectified. In the second place, Mr Beaumé has observed, that this operation may be greatly abridged, by taking care to receive none but the most volatile part in each distillation, and to leave a large residuum, which is to be neglected, and only the more volatile part to be further rectified. By this method a considerable quantity of fine oil may be obtained at three or four distillations, which could not otherwise be obtained at fifty or sixty. 1427 How rectified.

3. *Animal Fats*. Though these differ considerably from one another in their external appearance, and probably in their medicinal qualities, they afford, on a chemical analysis, products similar in quality, and differing but inconsiderably in quantity. They all yield a larger portion of oil, and no volatile salt; in which respect they differ from all other animal substances. Two ounces of hogs's lard yielded, according to Neumann, two drachms of an empyreumatic liquor, and one ounce five drachms and 50 grains of a clear brown-coloured oil of a volatile smell, somewhat like horse-radish. The *caput mortuum* was of a shining black colour, and weighed 10 grains. 1428 Animal fats.

Tallow being distilled in the same manner, two drachms of empyreumatic liquor were obtained from two ounces of it; of a clear brown oil, smelling like horse-radish, one ounce six drachms and 12 grains. The remaining coal was of a shining black colour, and weighed 18 grains. A particular kind of acid is now found to be contained in it. 1429 Tallow.

The marrow of bones differs a little from fats, when chemically examined. Four ounces of fresh marrow, distilled in the usual manner, gave over three drachms and a scruple of a liquor which smelled like tallow; two scruples and an half of liquor which had more of an empyreumatic and a sourish smell; two ounces and an half of a yellowish-brown, butyraceous oil, which smelled like horse-radish; and six drachms and an half of a blackish-brown oil of the same smell. The *caput mortuum* weighed four scruples. 1430 Marrow.

All animal fats, when perfectly pure, burn totally away without leaving any feces, and have no particular smell. In the state in which we commonly find them, however, they are exceedingly apt to turn rancid, and emit a most disagreeable and noxious smell; and to this they are peculiarly liable, when long kept in a gentle degree of heat. In this state, too, an inflammable vapour arises from them, which when on fire is capable of producing explosions. Hence, in those works where large bellows are used, they have been often suddenly burst by the inflammable vapours arising from the rancid oil employed for softening the leather 1431 Rancid oils purified.

Resins and Balsams.

leather. The expressed unctuous oils of vegetables are subject to the same changes; but from this rancidity they may all be freed most effectually, by the simple process of agitating them well with water: which is to be drawn off, and fresh quantities added, till it comes off at last clear and insipid, without any ill smell. The proper instrument for performing this operation in large is a barrel-churn, having in it four rows of narrow split deals, from the centre to the circumference, each piece set at obtuse angles to the other, in order to give different directions to the oil and water as the churn turns round, thereby to mix them more intimately. The churn is to be swiftly turned round for a few minutes; and must then be left at rest, till the oil and water have fully separated; which will be in 15 or 20 minutes, more or less, according to the size of the churn. When this water is drawn off, fresh water is to be put in, and the churn again turned round, and this continued till the oil is perfectly sweet. If the oil and water are allowed to stand together for some days, a gelatinous substance is found between them, which is not very easily miscible either with oil or water. Chalk, quicklime, and alkaline salts, are found also capable of taking off the rancidity from oils and fats; but have the inconvenience of destroying a part of their substance.

### § 4. *Resins and Balsams.*

These are commonly reckoned to be composed of an essential oil thickened by an acid; as the essential oils themselves are found to be convertible into a similar substance, by the exhalation of their more volatile parts. True resins are generally transparent in a considerable degree, soluble in spirit of wine, and possessed of a considerable degree of flavour.

1432 Whence procured. Resins are originally produced by inspissating the natural juices which flow from incisions made in the stems of growing vegetables, and are in that state called *balsams*. The balsams may be considered as essential oils thickened by losing some of their odoriferous principle, and of their finest and most volatile parts. There are several kinds of balsams, which, however, differ from each other only in the smell and degree of consistence; and therefore all yield similar products on distillation. An analysis of turpentine therefore will be sufficient as an example of the analysis and natural properties of all the rest.

1433 Turpentine Chio. The true turpentine-tree is found in Spain and the southern parts of France, as well as in the island of Chio and in the Indies. It is a middling-sized evergreen-tree, with leaves like those of the bay, bearing purplish, imperfect flowers; and on separate pedicles hard unctuous berries like those of juniper. It is extremely resinous; and unless the resin is discharged, decays, produces fungous excrescences, swells, bursts, and dies; the prevention of which consists wholly in plentiful bleeding, both in the trunk and branches. The juice is the *Chio* or *Cyprus turpentine* of the shops. This sort is quite of a thick consistence, of a greenish white colour, clear and transparent, and of scarcely any taste or smell.

1434 Venice. The kind now called *Venice turpentine*, is no other than a mixture of eight parts of common yellow or black rosin with five parts of oil of turpentine. What was originally Venice turpentine is now unknown. Neumann relates, that the Venice turpentine sold in his country was no other than that prepared from the larix tree, which grows plentifully in some parts of France, as also in Austria, Tyrol, Italy, Spain, &c. Of this there are two kinds; the young trees yielding a thin limpid juice, resembling balsam of copaiba; the older, a yellower and thicker one.

1435 Strasburg. The *Strasburg turpentine* is extracted from the silver-fir. Dr Lewis takes notice that some of the exotic firs afford balsams, or resins, superior to those obtained from the native European ones; as particularly that called *balm of Gilead fir*, which is now naturalized to our own climate. A large quantity of an elegant resinous juice may be collected from the cones of this tree: the leaves also, when rubbed, emit a fragrant smell; and yield, with rectified spirit, an agreeable resinous extract.

1436 Common. The common turpentine is prepared from different sorts of the pine; and is quite thick, white, and opaque. Even this is often counterfeited by mixtures of rosin and common expressed oils.

1437 Phenomena on distillation. All the turpentines yield a considerable proportion of essential oil. From sixteen ounces of Venice turpentine, Neumann obtained, by distillation with water, four ounces and three drachms of oil. The same quantity distilled, without addition, in the heat of a water-bath, gave but two ounces and an half; and from the residuum treated with water, only an ounce could be obtained. The water remaining in the still is found to have imbibed nothing from the turpentine; on the contrary, the turpentine is found to imbibe part of the water; the residuum and the oil amounting to a full ounce on the pound more than the turpentine employed. When turpentine is distilled or boiled with water till it becomes solid, it appears yellowish; when the process is further continued, of a reddish brown colour: in the first state, it is called *boiled turpentine*; and in the latter, *colophony*, or *rosin*.

On distilling sixteen ounces of turpentine in a retort with an open fire, increased by degrees, we obtain first four ounces of a limpid colourless oil; then two ounces and two drachms of a yellowish one; four ounces and three drachms of a thicker yellow oil; and two ounces and one drachm of a dark brownish red empyreumatic oil, of the consistence of balsam, and commonly called *balsam of turpentine*.

1438 Essential oil difficult of solution. The limpid essential oil called *spirit of turpentine*, is exceedingly difficult of solution in spirit of wine; tho' turpentine itself dissolves with great ease. One part of the oil may indeed be dissolved in seven parts of rectified spirit; but on standing for some time, the greatest part of the oil subsides to the bottom, a much greater proportion of spirit being requisite to keep it dissolved.

1439 Benzoin. 2. *Benzoin.* This is a very brittle brownish resin, of an exceedingly fragrant smell. The tree which produces benzoin is a native of the East Indies; particularly of Siam and the island of Sumatra. It is never permitted to exceed the sixth year; being, after this time, unfit for producing the benzoin. It is then cut down, and its place supplied by a young tree raised commonly from the fruit. One tree does not yield above three pounds of benzoin.

A tree supposed to be the same with that which affords

fords benzoin in the Eaſt Indies, is plentiful alſo in Virgina and Carolina; from whence it has been brought into England, where it grows with vigour in the open ground. The bark and the leaves have the ſmell of benzion; and yield with rectified ſpirit a reſin of the ſame ſmell; but no reſin has been obſerved to iſſue from it naturally in England, nor has any benzoin been collected from it in America.

1440 Soluble in ſpirit of wine.

Benzoin diſſolves totally in ſpirit of wine into a blood-red liquor, leaving only the impurities, which commonly amount to no more than a ſcruple on an ounce. To water, it gives out a portion of ſaline matter of a peculiar kind, volatile and ſublimable in the fire. See 984 *et ſeq*.

The principal uſe of reſins is in the making of lacquers, varniſhes, &c. See VARNISH.

## § 5. *Bitumens*.

THESE are inflammable mineral bodies, not ſulphureous, or only caſually impregnated with ſulphur. They are of various degrees of conſiſtency; and ſeem, in the mineral kingdom, to correſpond with the oils and reſins in the vegetable.

1441 Origin of bitumens.

Concerning the origin of bitumens, chemiſts are not at all agreed. Some chemical writers, particularly Mr Macquer, imagine bitumens to be no other than vegetable reſins altered in a peculiar manner by the admixture of ſome of the mineral acids in the earth; but Dr Lewis is of a contrary opinion, for the following reaſons.

"Mineral bitumens are very different in their qualities from vegetable reſins; and, in the mineral kingdom, we find a fluid oil very different from vegetable oils. The mineral oil is changed by mineral acids into a ſubſtance greatly reſembling bitumens; and the vegetable oils are changed by the ſame acids into ſubſtances greatly reſembling the natural reſins.

"From bitumens we obtain, by diſtillation, the mineral oil, and from reſins the vegetable oil, diſtinct in their qualities as at firſt. Vegetable oils and reſins have been treated with all the known mineral acids; but have never yielded any thing ſimilar to the mineral bitumens. It ſeems, therefore, as if the oily products of the two kingdoms were eſſentially and ſpecifically different. The laws of chemical inquiries at leaſt demand, that we do not look upon them any otherwiſe, till we are able to produce from one a ſubſtance ſimilar to the other. When this ſhall be done, and not before, the preſumption that nature effects the ſame changes in the bowels of the earth, will be of ſome weight."

1442 Naphtha.

There is a perfectly fluid, thin bitumen, or mineral oil, called *naphtha*, clear and colourleſs as cryſtal; of a ſtrong ſmell; extremely ſubtile; ſo light as to ſwim on all known liquors, ether perhaps excepted: ſpreading to a vaſt ſurface on water, and exhibiting rainbow colours; highly inflammable: formerly made uſe of in the compoſition of the ſuppoſed inextinguiſhable greek fire.

1443 Petroleum.

Next to this in conſiſtence is the *oleum petra*, or *petroleum;* which is groſſer and thicker than naphtha, of a yellowiſh, reddiſh, or browniſh colour; but very light, ſo as to ſwim even on ſpirit of wine. By diſtillation, the petroleum becomes thinner and more ſubtile, a groſs matter being left behind; it does not, however, eaſily ariſe, nor does it totally loſe its colour by this proceſs, without particular managements or additions.

Both naphtha and petroleum are found plentifully in ſome parts of Perſia, trickling through rocks or ſwimming on the ſurface of waters. Kempfer gives an account of two ſprings near Baku; one affording naphtha, which it receives in drops from ſubterraneous veins; the other, a blackiſh and more fetid petroleum, which comes from Mount Caucaſus. The naphtha is collected for making varniſhes; the petroleum is collected in pits, and ſent to different places for lamps and torches.

Native petrolea are likewiſe found in many different places, but are not to be had in the ſhops; what is ſold there for petroleum, being generally oil of turpentine coloured with alkanet root. The true naphtha is recommended againſt diſorders of the nerves, pains, cramps, and contractions of the limbs, &c. but genuine naphtha is rarely or never brought to this country.

There are ſome bitumens, ſuch as amber, ambergris, pit-coal, and jet, perfectly ſolid; others, ſuch as Barbadoes tar, of a middle conſiſtence between fluid and ſolid. Turf and peat are likewiſe thought to belong to this claſs.

1. *Amber*. This ſubſtance melts, and burns in the fire, emitting a ſtrong peculiar ſmell. Diſtilled in a ſtrong heat, it yields a phlegm, an oil, and a particular ſpecies of acid ſalt. The diſtillation is performed in earthen or glaſs retorts, frequently with the addition of ſand, ſea-ſalt, coals, &c. which may break the tenacity of the melted maſs, ſo as to keep it from ſwelling up, which it is apt to do by itſelf. Theſe additions, however, make a perceptible difference in the produce of the diſtillation: with ſome the ſalt proves yellowiſh and dry; with others, browniſh or blackiſh, and unctuous or ſoft like an extract: with ſome, the oil is throughout of a dark brown colour; with others, it proves externally green or greeniſh; with elixated aſhes, in particular, it is of a fine green. The quantity of oil and phlegm is greateſt when coals are uſed, and that of ſalt when ſea-ſalt is uſed. 1444 Amber.

The moſt advantageous method of diſtilling amber, however, is without any addition; and this is the method uſed in Pruſſia, where the greateſt quantities of ſalt and oil of amber are made. At firſt a phlegmatic liquor diſtils; then a fluid oil; afterwards one that is thick and more ponderous; and laſt of all, an oil ſtill more ponderous along with the ſalt. In order to collect the ſalt more perfectly, the receiver is frequently changed; and the phlegm, and light oil, which ariſe at firſt, are kept by themſelves. The ſalt is purified, by being kept ſome time on bibulous paper, which abſorbs a part of the oil: and changing the paper as long as it receives any oily ſtain. For the further depuration as well as the nature of this ſalt, ſee SUCCINUM. 1445 Moſt advantageouſly diſtilled without addition.

2, *Ambergris*. This concrete, which is only uſed as a perfume, yields, on diſtillation, products of a ſimilar nature to that of amber, excepting that the volatile ſalt is in much leſs quantity. See AMBERGRIS. 1446 Ambergris.

3. *Pit-coal*. See the articles COAL and LITHANTHRAX 1447 Pit-coal.

Bitumens. THRAX. This substance yields by distillation, according to the translator of the Chemical Dictionary, 1. phlegm, or water; 2. a very acid liquor; 3. a thin oil, like naphtha; 4. a thicker oil, resembling petroleum, which falls to the bottom of the former, and which rises with a violent fire; 5. an acid, concrete salt; 6. *an uninflammable earth* (we suppose he means a piece of charred coal, or cinder) remains in the retort. The fluid oil obtained from coals is said to be exceedingly inflammable, so as to burn upon the surface of water like naphtha itself.

1448 Peat. 4. *Peat*. There are very considerable differences in this substance, proceeding probably from the admixture of different minerals: for the substance of peat is plainly of vegetable origin; whence it is found to answer for the smelting of ores, and the reduction of metallic calces, nearly in the same manner as coals of wood. Some sorts yield, in burning, a very disagreeable smell, which extends to a great distance; whilst others are inoffensive. Some burn into grey or white, and others into red, ferruginous ashes. The ashes yield, on elixation, a small quantity of alkaline, and some neutral salts.

1449 Phenomena on distillation. The smoke of peat does not preserve or harden flesh like that of wood; and the soot into which it condenses is more apt to liquefy in moist weather. On distilling peat in close vessels, there arises a clear insipid phlegm; an acid liquor, which is succeeded by an alkaline one; and a dark-coloured oil. The oil has a very pungent taste, and an empyreumatic smell; less fetid than that of animal substances, but more so than that of mineral bitumens. It congeals, in the cold, into a pitchy mass, which liquefies in a small heat: it readily catches fire from a candle; but burns less vehemently than other oils, and immediately goes out upon removing the external flame. It dissolves almost totally in rectified spirit of wine, into a dark, brownish-red liquor.

## § 6. *Charcoal*.

1450 Differences between the coals of different substances. THIS is the form to which all inflammable matters are reducible, by being subjected to the most vehement action of fire in close vessels; but though all the coals are nearly similar to one another in appearance, there is nevertheless a very considerable difference among them as to their qualities. Thus the charcoal of vegetables parts with its phlogiston very readily, and is easily reducible to white ashes: charred pit-coal, or, as it is commonly called, *coak*, much more difficultly; and the coals of burnt animal substances, far more difficultly than either of the two. Mr Macquer acquaints us, that the coal of bullock's blood parts with its phlogiston with the utmost difficulty. He kept it very red, in a shallow crucible surrounded with charcoal, for six hours and more, stirring it constantly that it might be all exposed to the air, without being able to reduce it to white, or even grey ashes. It still remained very black, and full of phlogiston. The coals of pure oils, or concrete oily substances, and soot, which is a kind of coal raised during the inflammation of oils, are as difficultly burnt as animal coals. These coals contain very little saline matter, and their ashes furnish no alkali. These coals, which are so difficultly burnt, are also less capable of inflaming with nitre than others more combustible; and some of them, in a great measure, resist even the action of nitre itself.

1451 Charcoal perfectly refractory. Charcoal is the most refractory substance in nature; no instance having been known of its ever being melted, or showing the least disposition to fusion, either by itself, or with additions: hence, charcoal is found to be the most proper support for such bodies as are to be exposed to the focus of a large burning glass. The only true solvent of charcoal is *hepar sulphuris*. By the violent heat of a burning-glass, however, it is found to be entirely dissipable into inflammable air, without having any residuum. See AEROLOGY, n° 129. and CHARCOAL.

The different substances mixed with different coals, render some kinds of charcoal much less fit to be used in reviving metals from their calces, or in smelting them originally from their ores. The coals of vegetable substances are found to answer best for this purpose. See METALLURGY.

## SECT. V. *Vegetable and Animal Substances*.

(Vegetable and animal substances.)

THE only substances afforded by vegetables or animals, which we have not yet examined, are the mucilaginous, or gummy; and the colouring parts obtained by infusion, or boiling in water; and the calculous concretions found in the bodies of animals, chiefly in the human bladder. The colouring matter is treated of under the article *Colour-Making*, to which we refer; and in this section shall only consider the nature of the others.

### § 1. *Mucilage or Gum*.

THE mucilage of vegetables is a clear transparent substance, which has little or no taste or smell, the consistence of which is thick, ropy, and tenacious, when united with a certain quantity of superabundant water. It is entirely and intimately soluble in water, and contains no disengaged acid or alkali. 1452 Mucilage.

When mucilage is dissolved in a large quantity of water, it does not sensibly alter the consistence of the liquor: but, by evaporation, the water grows more and more thick; and, at last, the matter acquires the consistence of gum arabic, or glue; and this without losing its transparency, provided a heat not exceeding that of boiling water has been used.

Gums, and solid mucilages, when well dried and very hard, are not liquefied in the fire like resins, but swell, and emit many fumes; which are, at first, watery: then oily, fuliginous, and acrid. Distilled in close vessels, an aqueous acid liquor comes over along with an empyreumatic oil, as from other vegetable substances; a considerable quantity of coal remains, which burns to ashes with difficulty. 1453 Phenomena on distillation.

Mucilages and gums are not soluble either by oils, spirit of wine, alkalies, or acids, except in so far as they dissolve in these liquors by means of the water in which the alkali or acid are dissolved. They are, however, the most effectual means of uniting oil with water. Three parts of mucilage, poured upon one part of oil, will incorporate with it by trituration or agitation; and the compound will be soluble in water. Vegetable gums are used in medicine, as well as the mechanic arts; but the particular uses to which each of them is applicable, will be mentioned under the name of each particular gum.

1454 Jelly and glue.

The mucilage obtained from animal substances, when not too thick, is called *jelly*, or *gelatinous matter*; when further inspissated, the matter becomes quite solid in the cold, and is called *glue*. If the evaporation is still further continued, the matter acquires the consistence of horn.

This gelatinous substance seems to be the only true animal one; for all parts of the body, by long continued boiling, are reducible to a jelly, the hardest bones not excepted. Animal jelly, as well as vegetable mucilage, is almost insipid and inodorous; but, though it is difficult to describe the difference betwixt them when apart, it is very easily perceived when they are both together. Acids and alkalies, particularly the latter, dissolve animal jellies with great ease; but the nature of these combinations is not yet understood. The other properties of this substance are common to it with the vegetable gums, except only that the animal mucilage forms a much stronger cement than any vegetable gum: and is therefore much employed for mechanical purposes, under the name of *glue*. See GLUE and ISINGLASS.

### § 2. *Of the HUMAN CALCULUS.*

1455 Scheele's experiments on the human calculus.

THIS substance has been repeatedly examined by the most eminent chemists. Mr Scheele, as has been related n° 982, *et seq*. has been able to extract an acid from it. His account of it in other respects is to the following purpose.

1. All the calculi examined, whether flat and polished, or rough and angular, were of the same nature, and consisted of the same constituent parts.

2. The diluted vitriolic acid has no effect upon the calculus, but the concentrated acid dissolves it, and by abstraction from it is converted into the sulphureous kind, leaving a black coal behind.

3. Neither diluted nor concentrated spirit of salt had any effect upon it.

4. By means of nitrous acid, a new one was produced, and which is possessed of singular qualities, as already mentioned.

5. The solution of calculus in nitrous acid is not precipitated by ponderous earth, nor are metallic solutions sensibly altered by it.

6. It is not precipitated by alkalies, but grows somewhat yellower by a superabundance of the latter. In a strong digesting heat the liquor becomes red, and tinges the skin of the same colour. It precipitates green vitriol of a black colour; vitriol of copper, green; silver, grey; corrosive sublimate, zinc, and lead, white.

7. The solution is decomposed by lime-water, and lets fall a white precipitate, soluble in the muriatic acid without any effervescence: but though there be an excess of precipitate, the liquor still remains acid; which happens also with animal earth, and that of fluor dissolved in the same acids. On evaporation to dryness, the matter will at last take fire; but when heated only to a dull red heat in a close crucible, it grows black, smells like burnt alum, and effervesces with acids; being convertible before the blow-pipe into quicklime.

8. Neither this solution, nor the alkaline mixture, is changed by the acid of sugar.

9. The calculus is not changed by acid of tartar, though it is dissolved even in the cold by alkali, when reduced to such a state of causticity as not to discover the least mark of aerial acid. The solution is yellow and tastes sweetish; and is precipitated by all the acids, even by the aerial. It decomposes metallic solutions, but does not precipitate lime-water; and a smell of volatile alkali is produced by a little superabundance of alkali in the solution. Dry volatile alkali has no effect upon the calculus; but caustic volatile alkali dissolves it, though a pretty large quantity is required for this purpose.

10. Calculus is likewise dissolved by digesting in lime-water; and for this purpose four ounces of lime-water are required to twelve grains of the calculus; but the latter is partly precipitated by adding acids to the solution. By this union the lime-water loses its caustic taste.

11. Calculus is also dissolved entirely by pure water; but for this purpose a large quantity of fluid is required. Eight grains of calculus in fine powder will dissolve by boiling for a short time in five ounces of water. The solution reddens tincture of lacmus, but does not precipitate lime-water; and when it grows cold, the greatest part of the calculus separates in fine crystals.

12. On distilling a drachm of calculus in a glass retort, a volatile liquor was obtained resembling hartshorn, but without any oil; and in the neck of the vessel was a brown sublimate. On heating the retort thoroughly red hot, and then leaving it to cool, a black coal was left, weighing 12 grains, which retained its black colour on a red hot iron in the open air. The sublimate, which had some marks of fusion, weighed 28 grains, and became white by a new sublimation. Its taste was somewhat sourish, but it had no smell; it was soluble both in water and in spirit of wine; but a larger quantity of spirit than of water was requisite for this purpose. It did not precipitate lime-water, and seemed in some respects to agree with the sal succini. 1456

1456 His conclusions concerning its composition.

From these experiments our author concludes, that the human calculus is neither calcareous nor gypseous; but consists of an oily, dry, volatile acid, united with some gelatinous matter. The calculus is an oily salt, in which the acid prevails a little, since it is soluble in pure water; and this solution reddens the tincture of lacmus. That it contains phlogiston, appears from its solution in caustic alkalies and lime-water, but especially from the effect of the nitrous acid, by which it acquires quite different properties than from solution in alkalies; nor can it be precipitated from this solution. The animal gelatinous substance appears on distillation, by which a liquor is obtained resembling spirit of hartshorn, and a fine coal is left behind. 1457

1457 Is found universally in urine.

13. Calculus is found dissolved in all urine, even in that of children. On evaporating four kannes of fresh urine to two ounces, a fine powder is deposited as it cools, and a part firmly adheres to the glass. The precipitated powder readily dissolves in a few drops of caustic fixed alkali; and has in other respects all the properties of calculus. Of the same nature is the lateritious sediment deposited by the urine of those who labour under an ague. Mr Scheele suspected at first, that there was in this urine some unknown menstruum which kept such a quantity of powder dissolved, and which might afterwards evaporate by exposure to the air; but altered his opinion on perceiving that the sediment was equally deposited in close vessels.

14. All urine contains some animal earth combined with phosphoric acid; by the superabundance of which acid,

Calculus.

acid, the earth is kept diſſolved; and by reaſon of this ſuperabundant acid freſh urine communicates a red colour to lacmus. By ſaturation with cauſtic volatile alkali a white powder is precipitated; of which three drachms and an half are obtained from four kannes of urine. It is ſoluble in nitrous acid; and on adding the vitriolic, ſome gypſum is precipitated. On evaporating the nitrous acid, another remained, which precipitated lime-water; and when mixed with lamp-black, afforded phoſphorus by diſtillation; whence it is evident, that the white powder juſt mentioned contained lime and phoſphoric acid.

1458 Why freſh urine reddens lacmus.

1459 Salts, &c. contained in urine.

15. From theſe experiments Mr Scheele concludes, that all urine contains, beſides the ſubſtances already known (*viz.* ſal ammoniac, common ſalt, digeſtive ſalt, Glauber's ſalt, microcoſmic ſalt, ſal perlatum, and an oily extractive matter), a concrete acid, or that of calculus, and animal earth. It is alſo remarkable, that the urine of the ſick is more acid, and contains more animal earth than that of healthy perſons. With regard to the ſal perlatum, it was afterwards diſcovered by Mr Scheele not to be a peculiar acid, but only a phoſphoric acid diſguiſed by a ſmall quantity of foſſil alkali united with it. The analyſis is confirmed by ſyntheſis; for, by combining foſſil alkali with phoſphoric acid, our author obtained a true perlate acid.

1460 Bergman's account of the calculus.

In a ſupplement to Mr Scheele's diſſertation on the calculus, Mr Bergman obſerves, that he could not ſucceed in diſſolving it entirely either in pure water or in the nitrous acid, though the undiſſolved part was the leſs in proportion to the fineneſs of the powder to which the calculus was reduced. The undiſſolved part appears moſt conſpicuous, when ſmall pieces, or ſmall calculi of a few grains weight only, are put into a ſuperabundant quantity of menſtruum, and kept in a degree of heat very near to that which makes water boil. Here it will be obſerved, that the greateſt part of the piece is diſſolved; but that at the ſame time ſome ſmall white ſpongy particles remain, which are not affected either by water, ſpirit of wine, acids, or cauſtic volatile alkali. If the liquor be made fully to boil, theſe particles divide into white rare flocculi, and become almoſt imperceptible, but without any entire diſſolution. Mr Bergman could not collect a ſufficient quantity of them to determine their nature with accuracy; only he obſerved, that when expoſed to a ſtrong heat, they were reduced to a coal which burns ſlowly to aſhes, and is not ſoluble in diluted nitrous acid.

"When calculus veſicae (ſays he) is diſſolved in nitrous acid, no precipitation enſues on adding the acid of ſugar; whence one is readily induced to conclude, that there is no calcareous earth preſent, becauſe this experiment is the ſureſt way to diſcover it. But I have found, in the variety of experiments concerning elective attractions, that the addition of a third ſubſtance, inſtead of diſuniting two already united, often unites both very cloſely. That the ſame thing happens here I had the more reaſon to believe, becauſe the acid of ſugar contains ſome phlogiſtic matter, though of ſuch a ſubtle nature, that, on being burned, it does not produce any ſenſible coal; and the event of my experiment has ſhown, that I was not miſtaken in my conjecture. In order to aſcertain this point, I burned coals of the calculus to aſhes, which were quite white, and ſhowed in every reſpect the ſame phenomena as lime; cauſed ſome efferveſcence during their ſolution in acids, united with vitriolic acid into gypſum, were precipitated by the acid of ſugar, and were partly ſoluble in pure water, &c. Notwithſtanding this, there remains about one-hundredth part of the aſhes inſoluble in aquafortis; being the remainder of the ſubſtance abovementioned, which, together with the concrete acid, conſtitutes the calculus. If the calculus be diſſolved in nitrous acid, the ſolution filtered and evaporated to dryneſs, and the dry maſs calcined to whiteneſs, a calcareous powder is thus likewiſe obtained."

1461 Calcareous earth ſeparated from it by vitriolic acid.

As pure vitriolic acid contains no phlogiſton, our author ſuppoſed, that by dropping it, in its concentrated ſtate, into a ſolution of calculus in nitrous acid, the calcareous earth, if any exiſted in it, would be diſcovered. In this he was not diſappointed; for when the ſolution was ſaturated, ſome ſmall cryſtals were thus immediately ſeparated. Theſe, on examination, were found to be gypſum; and, after being diſſolved in diſtilled water, were precipitated by acid of ſugar. When the ſolution of calculus was very much diluted, no change appeared at firſt on the addition of oil of vitriol; but after a little evaporation, the abovementioned cryſtals began to appear. Some calculi of the bladder or kidneys at leaſt certainly contain lime, but ſeldom more than one half in an hundred parts, or one in 200 parts.

By the aſſiſtance of heat, concentrated vitriolic acid diſſolves the calculus with efferveſcence, and the ſolution is of a dark brown colour. On adding a little water, a kind of coagulation takes place; but by adding more, the liquor again becomes clear, and aſſumes a yellowiſh colour. Mr Bergman agrees with Mr Scheele in ſuppoſing that the muriatic acid has no effect upon the calculus; but he is in no doubt whether it may not extract ſome part of the calcareous earth.

1462 Red colour of the nitrous ſolution accounted for.

The red colour aſſumed by the ſolution of calculus in aquafortis is remarkable. A ſaturated ſolution diſcovers no ſmell of nitrous acid, and if evaporated by itſelf in a large open veſſel, the liquor aſſumes at laſt a deep red colour, and ſcarcely contains any nitrous acid: for, on the one hand, paper tinged with lacmus ſcarce ſhows any redneſs; and, on the other, the colour is deſtroyed irrecoverably by the addition of any acid. By quick evaporation the ſolution at laſt ſwells into innumerable bubbles; the foam grows redder and redder, and at laſt becomes dark red after it is quite dry. This dry maſs communicates its colour to a much larger quantity of water than before, and diſſolves very readily in all acids, even ſuch as have no action on the calculus; but they entirely deſtroy the colour, and that the more quickly in proportion to their degree of ſtrength; even alum has this effect on account of the ſmall quantity of looſe acid it contains. Cauſtic alkalies alſo diſſolve the colouring matter, and deſtroy it, but more ſlowly.

Our author endeavours to account for this red colour produced by the nitrous acid, from the peculiar nature of that acid and the effect it has upon phlogiſton. In order to obtain it, a proportionable quantity of acid muſt be made uſe of, and it ought to be diluted, that there may be no danger of going beyond the neceſſary limit. If too much be uſed, it will not produce the proper effect; but, by reaſon of its ſuperabundance, more or leſs, or even the whole, will be deſtroyed in proportion to the quantity. By pouring it in an undiluted ſtate on powdered calculus, it is con-

Calculus. converted in a few moments into mere foam. The acid of calculus is the more easily separated from the aquafortis by evaporation, as the latter is rendered more volatile by the inflammable particles of the former: alkali added to them both united does not produce any precipitation; a circumstance generally observed where two acids are united. In this case both the acids unite with the alkali, according to the different laws of their attraction. The red mass obtained after desiccation is, however, very different from the concentrated acid, such as is contained in the calculus; for it is of a darker colour, and very deliquescent: the least particle gives a rose colour to a very considerable quantity of water; but the muriatic and other strong acids always certainly destroy it; and, in a longer or shorter time, produce a colourless solution. This remarkable change depends, according to our author, more on the action of the nitrous acid upon the inflammable part, than upon any thing remaining behind.—Such red spots as are produced upon the skin by the solution, are likewise produced upon bones, glass, paper, and other substances; but more time is required for their becoming visible, though this too may be a little accelerated by means of heat.

1463 Experiments of Mr Higgins on this subject.

The following is an abstract of Mr Higgins's experiments upon this subject.

1. Eight hundred and forty grains of dry and well powdered calculus were introduced into a glass retort. It was taken from a laminated stone with a small nucleus, which was likewise laminated. The outward crust appeared very porous, but increased in density towards the centre. By the application of heat, an elastic fluid was first slowly extricated; and which, on examination, appeared to be composed of equal parts of fixed and phlogisticated air. The last portions came over very fast, and were attended with an urinous smell; and, by continuing the distillation, it became evident that fixed and alkaline air came over together without forming any union, as they ought, on the common principles of chemistry, to have done; though our author is at a loss to know why they did not unite, unless they were prevented by the small quantity of inflammable air which came over along with them.

From the beginning of the 10th measure, a black, charry, and greasy matter began to line the conical tube and air-vessel adapted to the retort; and as the process went on, the proportion of alkaline air decreased, while that of the inflammable air was augmented, until towards the end, when the last nine measures were all inflammable; after which no more would come over, though the retort was urged with a white heat. On breaking the distilling vessel, a black powder weghing 95 grains was found in it. On digesting this for an hour in ten ounces of distilled water, and then filtering and evaporating it to two ounces, a yellowish powder was precipitated, but no crystals were formed after standing a whole night. This powder was then separated by filtration, and the liquor evaporated to one ounce; during which time more powder was precipitated. It was then filtered a second time, and the liquor evaporated to half an ounce; when it began to deposit a white powder, and to emit a subacid astringent vapour, not unlike that of vitriolic acid. This white precipitate, when washed and dried, amounted only to one grain, had a shining appearance, and felt very soft, not unlike mica in powder. It was not changed, but rather looked whiter by exposing it to a fierce heat for ten minutes. It dissolved in distilled water without being precipitated by caustic volatile alkali. Mineral alkali, acid of sugar, and nitrated terra ponderosa, rendered the solution turbid; whence our author inferred, that the powder in question was selenite.

After the separation of this powder, the remaining solution was evaporated to dryness with a gentle heat. During the evaporation it continued to emit subacid vapours, leaving eleven grains of powder of a dirty yellow colour, having an aluminous taste. To this powder he added as much distilled water as was nearly sufficient to dissolve it; after which it was set by for three weeks. At the expiration of this term several small, transparent, and cubical crystals appeared on the side of the vessel above the surface of the solution; and these likewise had an aluminous taste. The whole was then dissolved in distilled water, and the solution filtered. Acid of sugar produced no change in the liquor for at least five minutes, but an immediate cloudiness took place on a mixture with volatile alkali; and on filtering the liquor it was again rendered turbid by mineral alkali, though the caustic alkali already predominated. Nitrated terra ponderosa threw down a copious precipitate, and Prussian alkali discovered a small quantity of iron. This aluminous solution left a yellow substance on the filter; which, when collected and dried, weighed only half a grain: it dissolved without effervescence in nitrous acid; acid of sugar caused no precipitation, but caustic volatile alkali threw down a precipitate which dissolved in distilled water. This solution was rendered turbid by the acid of sugar and muriated terra ponderosa, but no effect was produced by caustic volatile alkali or lime-water.

The yellow powder first deposited by the solution weighed two grains and a half, and by exposure to a strong heat acquired a deep orange colour. On digestion with distilled water, the insoluble part was reduced to three-fourths of a grain, and appeared to be iron: while the soluble part was found to be nothing else but gypsum. Our author, however, is of opinion, that this iron is impregnated with a small portion of vitriolic acid, though not in such quantity as to render it soluble.

The charred matter remaining in the retort was reduced by lixiviation with water to 80 grains. These were calcined with a red heat in an open fire, but could not be reduced to a grey powder in less than three quarters of an hour. When thoroughly calcined and cold, it weighed only 21 grains, which communicated to hot distilled water a limy taste, and gave it the property of turning syrup of violets green. Diluted vitriolic acid had no effect upon it, but it was rendered turbid by aerated volatile alkali and acid of sugar. The remainder when well dried weighed 16 grains, which dissolved in nitrous acid at first with a little effervescence; and when this ceased, the solution went on very slowly, until the whole was taken up. Acid of sugar made no change in the liquid, but the whole was precipitated by caustic volatile alkali. Prussian alkali threw down a grain, or perhaps more, of blue;

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blue; the precipitate digested with distilled vinegar lost a grain and an half, which was thrown down by caustic volatile alkali. The insoluble part being washed and digested in distilled water for half an hour, was partly dissolved; the solution was not affected by caustic volatile alkali, but acid of sugar and nitrated terra

1464 His account of its component parts.

ponderosa caused an immediate cloudiness. Seven grains and an half of the powder, which was insoluble both in acetous acid and distilled water, were readily taken up by diluted vitriolic acid, and precipitated by caustic volatile alkali: the 16 grains last treated, therefore, appeared to contain, of clay $7\frac{1}{2}$ grains; of selenite, six grains; magnesia, one and a half; and of iron, one grain. The proportions of the different ingredients in the whole calculus, therefore, according to Mr Higgins, are as follows:

| | Grains. |
|---|---|
| Iron | $2\frac{1}{9}$ |
| Selenite | 11 |
| Clay | $7\frac{1}{2}$ |
| Alum | 8 |
| Pure calcareous earth | 5 |
| Aerated magnesia | $1\frac{1}{2}$ |
| Charry combustible substance | 59 |
| In all | $94\frac{1}{9}$ |

1465 Experiments on the sublimate arising from it on distillation.

In this experiment, a darkish yellow sublimate adhered to the neck of the retort; the inner part next the retort more compact, but the rest of a lamellar spongy texture. This sublimate, when carefully collected, was found to weigh 425 grains, and readily dissolved in eight ounces of hot distilled water. A coaly substance was separated from this solution by filtration, which, when washed and dried, weighed ten grains, and when exposed to a red heat burned with a greenish flame, emitting white fumes, which smelled like vitriolic sal ammoniac: the residuum after calcination weighed half a grain, and was of a whitish colour: appearing insoluble in distilled water, but dissolving with effervescence in nitrous acid. Acid of sugar caused a very small precipitation, which did not take place until the mixture had stood for some time; but caustic volatile alkali instantly threw down a precipitate, which was taken up, when washed, by the acetous acid. The quantity was too small to be examined with greater accuracy; but it seemed to possess the properties of magnesia. The saline solution had the colour of small beer; and, when evaporated to two ounces, did not deposit any sediment, or yield any crystals. The black matter with which the conical tube and air vessel were lined, weighed 28 grains, and adhered so fast to the glass, that it was impossible to collect the whole from the fragments of the glass. When dissolved in distilled water and filtered, four grains of coals, similar to that obtained from the former, were procured; but no signs of crystallization were observed after evaporation to one ounce, and suffering the liquor to stand all night.

By this treatment the solution acquired the consistence of treacle; so that it was plainly not crystallizable, and therefore its analysis was plainly to be attempted after a different method. It was now put into a tubulated glass retort, together with six ounces of distilled water to wash it down. By distillation in a sandbath three ounces of water were procured, which differed in nothing from common distilled water, but in being coloured with a small quantity of the solution from the neck of the retort. On changing the receiver, about half an ounce of liquor of the same kind came over, after which the distillation began to be attended with an urinous smell. This continued barely perceptible for some time; but when about an ounce and an half had passed over, it became so very pungent, that our author could no longer doubt of its being in a caustic state. A small quantity of mild alkali, however, adhered to the lower part of the neck of the retort, some of which was washed down by the distillation; so that the proportions betwixt the two could not be ascertained. The volatile alkaline solution in the retort had the colour of spirit of hartshorn, and like it became darker coloured by the contact of air; on account of the evaporation of part of the alkali, and the rest becoming less capable of suspending the coaly matter mixed with it.

After all the liquor had passed over, and nothing remained in the retort but a small quantity of black matter, the fire was raised; and, as the heat increased, this black substance acquired a white colour, with a kind of arrangement on the surface, which was occasioned by the heat applied to the bottom of the retort being only sufficient to raise the salt to the top of the matter in the retort; but as the sand became nearly red-hot, white fumes began to appear, which condensed on the upper part of the retort, and a little way down the neck. The process lasted until the matter was nearly red-hot, when the fumes ceased, and nothing more passed over. The sublimate, when collected, was found to weigh 72 grains, a black porous brittle substance remaining on the bottom of the retort, which weighed 12 grains. This residuum, when exposed to a strong heat, emitted white fumes, with a slight alkaline smell; by which process it was reduced, with very little appearance of combustion, to a grey powder weighing three grains, which was accidentally lost.

Five grains of this purified sublimate, mixed with as much quicklime, emitted no smell of volatile alkali; and, when thrown upon a red-hot iron, emitted white fumes. The same effect was produced by a mixture of equal quantities of vegetable alkali and sublimate. The remainder, consisting of 62 grains, was divided into two equal parts; the one of which was mixed with two ounces of distilled water, and on the other was poured 60 grains of vitriolic acid diluted with half an ounce of water. These two mixtures being suffered to remain for six weeks, seemed to be but little acted upon. That with vitriolic acid was then put into a small matrass, and boiled on sand for half an hour with two ounces of distilled water, when the whole was taken up. The solution looked clear, and deposited nothing on standing. Mild mineral alkali had no effect upon it; but mild vegetable alkali threw down a copious sediment in white flocculi, which was redissolved by caustic alkali, lime-water, and partly by mild mineral alkali. Phlogisticated alkali, acid of sugar, and acid of tartar, had no effect upon it. The other portion of sublimate, which had been mixed with distilled water, was very little dissolved; but in pouring it into a matrass some small round lumps were observable on the bottom of the glass. These were

six

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six or seven in number, some weighing a whole grain, others not more than one-half. They were very hard and compact, with a smooth surface, and in figure resembling the nucleus of the original calculus. The whole was then put into a matrass with about three ounces of water. On boiling it on sand for three quarters of an hour, about one-half, of it was taken up: the solution passed the filter very clear whilst hot; but on cooling became turbid, and at last deposited white flocculi, which were redissolved on the addition of caustic volatile alkali and lime-water. It turned syrup of violets green; which, however, our author thinks might have been occasioned by its retaining volatile alkali, though it had not the smallest appearance of any such impregnation. He has nevertheless frequently observed, that sometimes the purest vegetable alkali contains volatile alkali, notwithstanding the various operations and degrees of heat it undergoes before it can be brought to the degree of purity at which it is called salt of tartar.

On filtering the solution to separate what had been deposited by cooling, no change was produced in the filtered liquor by mineral alkali; but mild vegetable alkali produced a cloudiness, which was instantly taken up on adding mineral alkali and lime-water. Neither Prussian alkali, nor the acids of arsenic, tartar, sugar, or borax, nor any of the three mineral acids, had any effect upon it.

1466 Experiments with nitrous acid.

2. An hundred and twenty grains of the same calculus were put into a tubulated glass retort, and half an ounce of strong nitrous acid poured upon it. An effervescence immediately ensued; and some part of the extricated aerial fluid being perserved, appeared to be fixed air mixed with a small quantity of nitrous air. When the effervescence ceased, a quarter of an ounce more of nitrous acid was added. On digesting the mixture upon hot sand for an hour, it emitted nitrous vapour and nitrous air; but the latter in very small proportion. When the solution was completed, the whole was poured into a small matrass, and gently boiled till the superabundant nitrous acid was nearly expelled. The solution was of a deep yellow colour and turbid; but on adding five ounces more of water, and digesting it for a quarter of an hour longer, it acquired the colour and consistency of dephlogisticated nitrous acid. On cooling it became somewhat turbid, and in a few days deposited a darkish yellow powder; which, when separated, washed, and dried, weighed little more than a quarter of a grain, and, on examination, was found to be a calx of iron.

1467 Crystallizes on exposure to the sun.

Our author being desirous to know what effect the sun would have upon it, placed it in a window where the sun shone full upon it for four hours every day. Here a little moisture seemed daily to exhale from it, the weather being hot, and the matrass, which had a short wide neck, being only covered, with bibulous paper to keep out the dust. In this situation, in the course of a week, a few very small crystals appeared to float upon the surface. These in time fell to the bottom, where they adhered together so as to form a hard concretion, still retaining a crystalline appearance, but so small and confused, that it was impossible to distinguish their figure; and this deposition of crystals continued for a month, after which it seemed to cease. The solution was then filtered to separate the salt; after which one-half of the liquor was evaporated away, and the rest set in the usual place for a fortnight longer, but no more crystals appeared. The salt, which weighed three grains, was then digested in four ounces of distilled water; but no part seemed to be dissolved. Three ounces of the water were then decanted off, and six drops of vitriolic acid added to the remainder, which by the help of digestion seemed to dissolve the salt slowly; but on adding half an ounce more distilled water, the whole was readily taken up. Acid of sugar had no effect on this solution; but lime-water rendered it turbid. The whole was then precipitated with caustic volatile alkali, and the solution filtered, which likewise threw down the lime from lime-water. The precipitate was then washed, and distilled vinegar poured upon it, which did not take it up; but it was dissolved by marine acid. Phlogisticated alkali had no effect upon it; and the acid of sugar occasioned very little cloudiness after standing three or four hours; from which our author supposed that the matter was phosphorated clay.

The solution, being now free from iron and phosphorated clay, had a subacid taste, and looked clearer, though still retaining a yellow cast. Acid of sugar had no effect upon it; but nitrated terra ponderosa threw down a precipitate, as did likewise the caustic volatile alkali. Mild vegetable alkali caused no precipitation; which our author attributed to the solution of the manganese and clay by the fixed air extricated from the alkali. Two-thirds of the solution were then put into a small glass retort, and two ounces distilled off, which had no taste, but smelled very agreeably, and not unlike rose-water. After all the liquor had passed over, white fumes appeared in the retort, and these were soon followed by an aerial fluid. On collecting some of this, a candle was found to burn in it with an enlarged flame. Nitrous air did not diminish it in the least; and it seemed to be that species of air into which nitrous ammoniac is convertible. No more than 13 or 14 inches of this kind of air could be obtained; and as soon as it ceased to come over, crystals were observed in the lower part of the neck of the retort. On augmenting the heat, a white salt began to sublime and adhere to the upper part of the retort; the operation was continued until the retort was red-hot; but, on breaking it, the quantity of sublimate was so small, that very little of it could be collected; though, from the small quantity obtained, our author was convinced of its being the same in quality with what was obtained in the former analysis. The salt which crystallized in the neck of the retort was nitrous ammoniac, as appeared from its detonation *per se*, &c. A grey powder was left in the bottom of the retort, which hot distilled water partly dissolved; muriated terra ponderosa, acid of sugar, and vegetable alkali, rendered this solution turbid: but caustic volatile alkali had no effect upon it. The remaining part of the powder which was left by the distilled water, readily dissolved with effervescence in the marine acid, and was precipitated by caustic volatile alkali; the part soluble in distilled water appearing to be gypsum, and that soluble in marine acid to be magnesia.

From all these experiments, Mr Higgins concludes the composition of the human calculus to be vastly different

 ferent from what either Mr Scheele or Mr Bergman have supposed it to be. "It appears (says he), that the calculus was composed of the following different compounds blended together; *viz.* selenite, alum, microcosmic salt, mild volatile alkali, lime, and caustic volatile alkali, combined with oil, so as to form a saponaceous mass; calx of iron, magnesia combined with aerial acid, clay enveloped by a saponaceous and oily matter, and the sublimate already described." Considering this to be the true state of the calculus in the bladder, the small proportions of clay, selenite, magnesia, and iron, which are the most insoluble of the ingredients; the great solubility of microcosmic salt and alum, and the miscibility of lime, volatile alkali, and oil, in water; tend to show, that the sublimate is the cementing ingredient. Indeed, its insolubility in water, and property of forming nuclei out of the body, as above observed, leave no room to doubt it. The proportion of the other ingredients, and very likely their presence, depend upon chance. volatile alkali and oil excepted; therefore this sublimate should be the object of our investigation.

1468 Higgins's account of the constituent parts of calculus.

1469 Remarks on the remedies proper for dissolving it.

Mr Higgins concludes his dissertation with some practical remarks concerning the remedies proper for dissolving the stone, for counteracting that disposition in the body which tends to produce it, and concerning the regimen proper for those who are to undergo the operation of cutting for it. "The effect of mild mineral alkali (says he) on the sublimate, is well worth the attention of those who may have an opportunity of trying its efficacy. Mild mineral alkali may be taken in large doses, and continued for a length of time with impunity to the most delicate constitutions, only observing a few circumstances; but this alkali, in a caustic state, must very often be attended with mischievous consequences. Besides, if we consider that it must enter the mass of blood before any part can reach the bladder, and the small portion of the dose taken secreted with the urine, and, lastly, the action of caustic alkali upon animal substances; we shall be at a loss to know on what principle caustic alkalies have been recommended in preference to mild. Soap itself might as well be recommended at once; for soon after caustic alkali is taken, it must be in a saponaceous state. Fixed vegetable alkali should be avoided, and the perference given to the other two alkalies. As it is evident that alkalies have no real action on the stone in the bladder, though their efficacy has been experienced in alleviating the disease when timely administered, their mode of action is only explicable in the following manner: They either prevent the generation of the sublimate in the system, or else keep it in solution in the mass of fluids: and being in the utmost degree of divisibility, its ultimate particles are capable of passing through the most minute emunctories; by which means it is carried off by other secretions as well as the urinary. Thus urine, not being saturated with this matter, acts as a solvent on the stone; and as the most soluble parts are first washed away, it falls through time into fragments of irregular surfaces, which by their friction irritate and inflame the bladder, as has been observed by several practitioners.

"Allowing that the sublimate is the cementing substance in the calculus, and judging, from the effects of alkalies upon it, their *modus operandi* in the constitution, it remains now to inquire into the origin of the calculus. Mr Scheele has found this sublimate in the urine of different persons; and hence inferred, that it was a common secretion; but it still remains to be ascertained, whether there be a greater quantity of it procured from the urine of patients who labour under this disorder than in those who do not? If this should not be the case, may not a deficiency of volatile alkali in the constitution be the cause of the concretions in the kidneys, bladder, &c.; or, which must have the same effect, too great a proportion of acid, which, uniting with the alkali, may take up that portion which would have kept the sublimate in solution until conveyed out of the system by the urinary and other secretions; and may not this be the phosphoric acid? If this latter should be the case, an increase of microcosmic salt must be found in the urine; but if the former, a decrease of the volatile alkali, and no increase of the neutral salt. The small quantity of phosphoric acid found in the calculus proceeds from the solubility of microcosmic salt. Do not volatile alkali and phosphoric acid constitute a great part of the human frame? and is their not a process continually carried on to generate these in the system? and is not this process liable to be retarded or checked by intemperance, &c. which may vary their quantities and proportions? and may not a due proportion of these be necessary to a vigorous and sound constitution? If so, no wonder that an increase or deficiency in either or both of these should be productive of several disorders."

On this subject, however, our author has not had sufficient leisure to make the experiments necessary for its elucidation. Indeed, it seems not easy to do so; as, in his opinion, at least 500 would be required for the purpose. "That the urinary sublimate is present in tubercles found in the lungs of persons who die of pulmonary consumptions, and likewise in what are vulgarly called *chalk stones*, is what I have experienced: but in what proportion, or whether in quantities sufficient to cause the concretion, is what I cannot say; for I have had but a few grains of each to examine. I have every reason to suspect, that consumptions and scorbutic complaints very frequently arise from a superabundance of this sublimate in the system; and that it is chiefly the cause of the gout and rheumatism, and solely the cause of the stone in the bladder. I make no doubt but these disorders generally proceed from obstructions: and it is probable, that either a precipitation of this sublimate in the system, or else a deficiency of some other secretion, which would hold it in solution until conveyed out of the body, may be the chief cause of those obstructions; and likewise, that different degrees of precipitation may produce different symptoms and disorders.

1470 Sublimate of calculus found in consumptive and gouty people.

"That mineral or volatile alkali and bark have been useful in the above disorders, has been affirmed by experienced physicians; and I know an instance myself of mineral alkali and nitrous ammoniac being serviceable in a pulmonary complaint of some standing.

"With respect to the stone, when it acquires a certain magnitude, it is absurd to attempt to dissolve it in the bladder, it wastes so very slowly; and during this time the patient must suffer vast pain, particularly when

Vitriolic ether.

when the ſtone acquires a rugged ſurface: therefore cutting for it at once is much preferable.

"Mineral alkali taken in the beginning of the complaint, and before the ſtone accumulates, will no doubt check its progreſs, and may in time change that diſpoſition in the habit. Patients who are cut for the ſtone ſhould, I think, take mineral alkali for ſome time when the wound is healed, but not before, for fear of bringing on a mortification."

Nitrous acid.

# APPENDIX;

## Containing ſuch Discoveries as have appeared ſince the Compilation of the Article, and which could not be inſerted in their proper Places.

### I. *Vitriolic Ether.*

1471 Various methods of rectifying vitriolic ether.

M. Pelletier formerly propoſed a method of rectifying this fluid by putting manganeſe into the veſſels; but as the vitriolated manganeſe might perhaps communicate ſome injurious quality, another method is propoſed by M. Tingry. After firſt drawing off the ether, he adds a diluted ſolution of volatile alkali, and avoids as much as poſſible the diſſipation of the vapours: the ether is then rediſtilled. It may afterwards in this way be waſhed more ſafely, and with leſs loſs. The little proportion of the ether which is ſeparated in the water, may be again recovered, or the water may be again employed for the ſame purpoſe. M. Lunel propoſes calcined magneſia for this purpoſe, as its ſalt is not ſoluble; though perhaps pure terra ponderoſa might be better.

### II. *Nitrous Acid.*

1472 Mr Higgins's obſervations.

On this ſubject Mr Higgins has ſeveral curious and intereſting obſervations. "It is not an eaſy matter (ſays he), to aſcertain exactly the greateſt quantity of dephlogiſticated air, which a given quantity of nitrous acid may contain. I always found nitre to vary, not only in its product of phlogiſticated and dephlogiſticated air, but likewiſe in their proportion to one another. The pureſt nitre will yield, about the middle of the proceſs, dephlogiſticated air ſo pure as to contain only about $\frac{1}{13}$ of phlogiſticated air. In the beginning, and nearly about the latter end of the proceſs, air will be produced about twice better than common air. On mixing the different products of a quantity of pure nitre, it was found that, by expoſure to liver of ſulphur, $\frac{1}{6}$ part was left unabſorbed; and this was the utmoſt purity in which I obtained dephlogiſticated air from nitre.

1473 Account of its conſtituent parts by M. Lavoiſier.

"According to M. Lavoiſier, 100 grains of nitrous acid contain $79\frac{1}{2}$ of dephlogiſticated air, and $20\frac{1}{2}$ of phlogiſticated air, which is not quite four to one. But his experiments contradict this; for whatever mode he adopted to decompoſe nitrous acid, it appeared that the proportion of dephlogiſticated air was nearly as five to one of phlogiſticated air.

1474 By Mr Cavendiſh.

"Mr Cavendiſh has proved, that nitrous acid may be formed by taking the electric ſpark in a mixture of three parts of phlogiſticated air, and ſeven of dephlogiſticated air, which is but $\frac{1}{7}$ more of dephlogiſticated air than nitrous air contains; which may apparently contradict M. Lavoiſier's, as well as my own, eſtimation of the proportion of the conſtituent principles of nitrous acid, when in its perfect ſtate. The red nitrous vapour contains three parts of nitrous air and one of dephlogiſticated air, or one of phlogiſticated and three of dephlogiſticated air; but nitrous vapour may be formed with a leſs proportion of dephlogiſticated air; and which, though it may not be ſo condenſible as a more perfect nitrous vapour, yet will, when in contact with pure alkali, unite with it, and form nitre, as was the caſe in the experiment of Mr Cavendiſh. The common ſtraw-coloured nitrous acid contains more dephlogiſticated air than the red nitrous acid or vapour; the proportion appears to be about four to one; but the colourleſs contains about five of dephlogiſticated to one of phlogiſticated air.

1475 Method of obtaining colourleſs nitrous acid.

"Having once a charge of nitrous and vitriolic acid in a green glaſs retort, I put it in a ſand-pot to diſtil; but the pot being ſmall, the edge came too near the retort, about a quarter of an inch or more above the charge; which, before the proceſs commenced, and when it acquired more than the heat of boiling water, cracked it all round in that direction. Being thus ſituated, I was obliged to withdraw the fire, and, before the charge got cold, to ladle it into an earthen pan. On introducing it into a freſh retort, I obtained from it nitrous acid nearly as colourleſs as water. The vitriolic acid uſed in this proceſs not being very perfect, the goodneſs of the nitrous acid was attributed to the purity of the nitre from whence it was diſtilled; but in another proceſs, though the ſame nitre was uſed with much purer vitriolic acid, the produce was of an high ſtraw colour. On recollecting the abovementioned circumſtance, the vitriolic acid and nitre were next mingled in due proportion, and expoſed in an earthen pan ſet in ſand, to nearly the heat of boiling water, for half an hour or more, continually expoſing freſh ſurfaces to the air. When the charge was quite cold, I introduced it into a retort, and diſtilled as colourleſs nitrous acid as the former. As no nitrous air was emitted during digeſtion, it muſt have imbibed dephlogiſticated air from the atmoſphere."

1476 How to ſet charcoal on fire by means of nitrous acid.

Mr Prouſt found, that ſtrong nitrous acid will ſet fire to charcoal if it be rendered very dry. He likewiſe remarked, that charcoal expoſed to the air a few hours after calcination, was unfit for the experiment. Charcoal, he obſerves, attracts moiſture very forcibly. The firſt effect of the charcoal on the nitrous acid, he obſerves, is to withdraw a portion of its water from it; by which it is rendered highly concentrated, at the ſame time that the condenſation of the water heats the charcoal in a ſmall degree, but ſufficiently to volatilize a nitrous vapour; which, as ſoon as it reaches that portion of dry charcoal next the humid part, is condenſed

Nitre.

densed by it, and generates heat enough to promote the decomposition of the nitrous acid. Hence we see why the experiment will not succeed if the acid be poured on the surface of the charcoal.

1477 Effect of nitrous acid on blood.

The effect of nitrous acid on blood, according to Mr Higgins, is very singular. Two parts of blood procured fresh at the butchers, one of strong nitrous acid, and about one fifth of the whole of water, were digested in the heat nearly of boiling water (fresh portions of water being occasionally added until the whole of the acid was expelled), when it acquired almost the colour, and exactly the taste, of bile. When mixed with a large quantity of water, it acquired a fine yellow colour; and, on standing, deposited a substance of a brighter yellow, though the supernatant liquor still retained a yellow colour and bitter taste, but not so intensely as when the precipitate was suspended in it. The different stages of this process were well worthy of observation. No nitrous air was produced, and the acid was expelled in the state of a white vapour. The liquor was found to increase in bitterness as the acidity vanished. About the middle of the process, the solution first tasted acid, but was quickly succeeded by a bitter sensation. It appears that the nitrous acid took dephlogisticated air from the blood; for though red nitrous acid was used, it was expelled in a perfect state.

### III. *Nitre.*

Though the artificial generation of the nitrous acid, from a mixture of dephlogisticated and phlogisticated air, is now sufficiently understood, yet we do not well know in what manner nature performs the operation. Some chemists, particularly M. Thouvenal, have found, that putrefaction favours the production of nitrous acid. All animal substances, during their decay, give out a vast quantity of phlogisticated air; therefore, if dephlogisticated air be present, it will unite to the phlogisticated air in its nascent state, and

1478 Nitre generated without putrefaction.

form nitrous acid: but Mr Higgins has observed, that nitrous acid may be generated in plenty where there is no putrid process going on. "The chemical elaboratory at Oxford (says he) is near six feet lower than the surface of the earth. The walls are constructed with common limestone, and arched over with the same; the floor is also paved with stone. It is a large room, and very lofty. There are separate rooms for the chemical preparations, so that nothing is kept in the elaboratory but the necessary implements for conducting experiments. There is an area adjoining it on a level with the floor, which, though not very large, is sufficient to admit a free circulation of air. The ashes and sweepings of the elaboratory are deposited in it. There is a good sink in the centre of this area, so that no stagnated water can lodge there. Notwithstanding all this, the walls of the room afford fresh crops of nitre every three or four months. Dr Wall, who paid particular attention to this circumstance, and who told me it contained fixed vegetable alkali, requested I would analyse it, and let him know what it contained. I found that two ounces of it contained six drachms of nitrated fixed vegetable alkali, and three of calcareous nitre. The nitre first appears in small whitish filaments as fine as cob-web, which, when they get a little larger, drop off; so that they never acquire sufficient growth to distinguish their figure to a naked eye. On finding that they contained fixed vegetable alkali, I concluded that it proceeded from minute vegetation; but in this I was mistaken; for I found that they were soluble in water, and that they detonated with charcoal at every stage of their growth. Having swept this saline efflorescence from the wall, I dug deep into it, but could not obtain nitre from it. When a part had been white-washed, it yielded nitre, but not so abundantly as a neighbouring spot which had not been treated in the same manner. Hence it is evident, that nitrous acid may be formed without the assistance of putrescent processes in a still damp air, where there is a substance to attract it when half formed, whereby it is in time brought to perfection. The above facts moreover prove, that fixed vegetable alkali is a compound."

Marine acid.

### IV. *Marine Acid.*

1479 Unsuccessful attempts to decompose sea-salt

Mr Higgins informs us, that he has, with a view to decompose sea-salt, mixed it with manganese in various proportions, and exposed them in a reverberating furnace in a well closed crucible for three hours, to a heat nearly sufficient to melt cast iron. In the same manner he treated manganese, salt, and charcoal, as well as clay, salt, and charcoal, and salt and clay alone, with very little success. He treated calcined bones, salt, and charcoal, and calcined bones and salt, as well as lime and salt, in the same manner, without effecting any apparent change in the salt. He was informed, however, by Mr Robertson, apothecary in Bishopsgate-street, that he had partially alkalized it, by exposing it with clay to a fierce heat; but that soon after it got into contact with air, it became neutral again. "If common salt and litharge be fused (says Mr Higgins), it is in part decomposed; the acid suffers no decomposition, but unites with the lead; whereby it acquires, when the saline matter is washed away, a yellow colour. It is evident (adds he) from these facts, that the basis of marine acid is a combustible body, and quite different from light inflammable air, charcoal, or any known inflammable substance; and that it attracts dephlogisticated air with greater force than any substance hitherto discovered. Though charcoal will decompose all other acids, except a few, when united to bodies which will fix them until they acquire a sufficient degree of heat, yet it has no effect upon marine acid."

According to Fourcroy, if alkaline air be confined by mercury, and dephlogisticated marine acid air be added to it (which must be done quickly, as the acid air would dissolve the mercury), each bubble produces a slight detonation, and furnishes a very amusing spectacle.

1480 Method of distilling spirit of salt with clay.

Though in Britain the distillation of the spirit of salt with clay has long been entirely laid aside for the process with oil of vitriol, yet it is still practised in other countries, and may be effected in the following manner: Having previously decrepitated the salt, and dried the clay, they are then to be ground, mixed, and sifted together. The mixture is next to be worked with a spatula, and then with the hands, until it is brought into a moderately stiff and uniform mass. This

Marine acid.

This is to be divided into balls about the size of a pigeon's egg, so that they can pass through the neck of the retort; but before they are put into the distilling vessel, it is proper to dry them thoroughly. The retorts must be of stone-ware, and carefully coated, in order to prevent them from breaking with the intense heat to which they are exposed. They are to be filled two-thirds full of materials, and the distillation must be performed in a reverberatory furnace. The receiver at first is not luted on, because that which rises in the beginning of the distillation, being very aqueous, is to be put by itself. When this has come over, another receiver is then to be applied, and cemented with fat lute, and covered with a cloth daubed with a mixture of lime and the whites of eggs. The heat is to be raised until the retort is red-hot, and continued in this degree until the distillation ceases.

Various proportions of clay and salt have been recommended for this process; but it seems probable that not less than ten parts of clay to one of salt, as Pott has directed, will be found necessary. Instead of the clay, some direct the use of bole; but this is inconvenient on account of the iron it contains. Powdered talc has also been recommended, but this is not always free from iron; and where a very pure spirit is wanted, there is a necessity for having recourse to oil of vitriol, and glass or stone-ware vessels. As the marine acid cannot be separated from the earthy mixtures abovementioned, but by means of moisture, M. Beaumé advises to moisten the residuum, and repeat the distillation, by which more acid will be obtained.

1481 Effect of marine acid upon phlogistic matters.

As the marine acid has very little action upon phlogistic matters, it cannot therefore affect oils, either expressed or essential, in a manner similar to the vitriolic or nitrous. M. Marges, however, has observed yellow crystals resembling amber formed in bottles, containing a mixture of oils and marine acid of moderate strength, which had stood for several months. The little effect which the marine acid has upon these substances was first supposed to be owing to its want of phlogiston in itself; but when it was afterwards found, that, by the application of certain substances which have a great attraction for phlogiston, the marine acid was rendered capable of uniting very readily with inflammable matters, the former theory was abandoned. It was now asserted, that the acid, instead of containing no phlogiston, was naturally endowed with a very considerable quantity; and that, in its new state, it was dephlogisticated by the substances applied. On the other hand, the antiphlogistians asserted, that no change was thus made upon it, farther than adding a quantity of pure air, which they suppose to be the basis of all acids. On this subject, however, M. Cornette maintains, that the marine acid seems to have so little action upon inflammable substances, merely because it is weaker than the rest; and likewise that it is often previously combined with some inflammable matter, by which its attraction is prevented. He maintains, that if the marine acid be concentrated in such a manner as to render its specific gravity to that of water as 19 to 16, it will then act upon oils with heat and effervescence, reducing them to a black and thick substance, and even burning them to a kind of coal. Some experiments have been made by Mr Hasse, with a view to investigate the action of the marine and vitriolic acids upon balsams and oils; for which purpose he mixed two drachms of smoking spirit of salt with one of each of the oily substances to be tried. The results were, that Canada balsam gained one scruple in weight; balsam of capivi 19 grains; storax, and Venice turpentine, each one scruple; asphaltum 18 grains; but the essential oils of anise-seed, benzoin, bergamot, coriander, and many others, were not altered in any degree. The action of this acid upon inflammable matters, however, is augmented by its being reduced into the form of air.

Gmelin relates, that, by distilling a mixture of five parts of salt, twelve of spirit of wine, and four of vitriolic acid, to which he had previously added one or two parts of water, he obtained a completely dulcified spirit of salt, and an imperfectly dulcified spirit of vitriol, upon rectifying the liquor.

1482 Glass corroded by it.

Homberg found, that glass was corroded by the marine acid: and his observation has been confirmed by Dr Priestley; who finds that its corrosive power is augmented by confining the acid in tubes hermetically sealed. Its power is exerted not only on flint-glass, but even on common green glass; though more powerfully on the former, where it chiefly attacks the red-lead used in its composition. By inclosing marine acid gas for some weeks in a glass tube exposed to heat, an incrustation was formed on the inside, while the air was diminished to $\frac{1}{8}$ of its original bulk, one half of which was absorbed by water; the other was phlogisticated air.

1483 Cause of the yellow colour of marine acid.

The marine acid is generally met with of a yellow or reddish colour, which by Macquer is given as one of its characteristic marks. In general, however, this colour is thought to proceed from iron; but Dr Priestley has found that it may be produced by many different substances; and his observations have been confirmed by Scheele and other chemists. The Doctor is of opinion that it is occasioned for the most part, if not always, by a mixture of earth; and he was able to communicate it by means of calcined oyster-shells, calcined magnesia, pipe-clay, or pounded glass; but not by wood-ashes, from whence the air had been expelled by heat. It was effectually discharged by flowers of zinc, a coal of cream of tartar, and by liver of sulphur; but he found that the colour which had been discharged by liver of sulphur, would return by mere exposure of the acid to the atmosphere, but not that which had been discharged by flowers of zinc.

*Dephlogisticated spirit of salt.*

1484 Expeditious method of bleaching linen.

When the action of this vapour upon any thing is to be examined, the substance must be put into a bottle in such a manner as to remain in contact with it; or it may be put into a glass tube, which is suspended and fixed to the stopper, and thus introduced into the bottle.—From its property of destroying all vegetable colours, it promises to be of very considerable use in the arts, provided it could be had in sufficient quantity, and cheap. It bleaches yellow wax, and when properly applied to linen, will whiten it sufficiently, and without injury in a few hours. This may be effected by steeping the linen for that space of time in water impregnated with the dephlogisticated marine gas. It unites with this fluid rather more easily than fixed air.

Ber-

Marine acid.

Berthollet, in order to impregnate water with it without exposing the operator to the fume, which is extremely disagreeable, put the mixture of marine acid and manganese into a retort. To this he applied first an empty bottle, and then several others filled with water, and communicating with each other by means of bent tubes; surrounding the whole with ice. When the water in the bottles was saturated, the gas became concrete, and fell to the bottom; but with the smallest heat it arose to the top in bubbles. The specific gravity of the saturated water was to that of distilled water, when the thermometer was only five degrees above the freezing point, as 1003 to 1000. This impregnated water is not acid, but has an austere taste, and has the same action as the gas, though in a weaker degree. Mr Berthollet has observed, that the addition of alkalies does not prevent, but rather promotes, the discharge of colours; for which reason he directs to add a fixed alkali to the impregnated water in which linen is to be steeped for bleaching. This is the expeditious method hinted at under the article BLEACHING; but which has not hitherto come into use, principally through the high price of the dephlogisticated gas.

The dephlogisticated marine acid does not discharge all colours with equal ease. Those of litmus and syrup of violets are entirely destroyed, and turned white. The colouring matter of Brazil-wood, and some green parts of plants, retain a yellow tint. The leaves of evergreen plants resist its action for a long time, and at last only acquire the yellow colour which they assume by long exposure to the air; and in general the changes of colour which vegetable matters suffer from this gas, are similar to those which take place on long exposure to the air; and by this operation the gas is converted into common marine acid.

1485 Effect of the dephlogisticated acid on phlogistic matter, &c.

Oils and animal fats are thickened by this gas; and by these and other inflammable substances it is reduced to the state of common marine acid. Light is said to produce the same effect. It unites with fixed alkalies and calcareous earths, but without any sensible effervescence; and thus they lose their peculiar taste and colour. M. Berthollet having boiled in a retort, to which a pneumatic apparatus was affixed, some of the dephlogisticated marine acid liquor with mineral alkali, thus obtained a considerable quantity of elastic fluid, composed partly of fixed air, partly of the air contained in the vessels, and partly of air considerably purer than that of the atmosphere. The result of the combination was common salt. On repeating the experiment with lime, no fixed air was obtained; but that which came over became gradually more and more dephlogisticated. Volatile alkali, even when caustic, occasioned an effervescence, and emitted a peculiar kind of air, which was neither fixed nor dephlogisticated, but of a peculiar kind.

Green vitriol is changed to a red by the dephlogisticated gas, but the colour of blue and white vitriol is not affected. By the assistance of light, it acts upon phosphorus, and the result is phosphoric and common marine acids. It does not dissolve ice nor camphor; in which respects it differs from the common marine acid gas.

1486 Marine ether.

On mixing marine acid, manganese, and spirit of wine, and distilling them with a very gentle heat, little air of any kind is produced, but a quantity of ethereal liquor very slightly acid. The proportion used by Pelletier were an ounce and a half of manganese, five ounces of concentrated marine acid, and three ounces of spirit of wine. "In this process (says Mr Kier), the whole of the dephlogisticated acid seems to have united with the spirit of wine, and to have formed ether. The difficulty of combining marine acid with spirit of wine, so as to form an ether, is well known, and though there have been some approximations to it, yet the only instances in which it has been completely effected, have succeeded in consequence of the marine acid being dephlogisticated; by which its action on spirit of wine, as well as on all inflammable matters, is greatly increased."

M. Pelletier has observed, that when we put a bit of phosphorus into dephlogisticated marine gas, the former is immediately dissolved, and a light is perceived, the vessel being filled at the same time with white vapours. He has likewise observed, that sea-salt, with an excess of pure air, thrown into heated vitriolic acid produces a small detonation. To make this salt in quantity, take, for instance, ten pounds of sea-salt, mixing it with from three to four pounds of manganese, pour on the mixture ten pounds of vitriolic acid, and distil with Woulfe's apparatus. Pass the disengaged acid through a solution of fixed vegetable alkali, either caustic or otherwise. A little more than ten ounces of the new marine salt with excess of pure air is obtained, and a quantity of salt of Sylvius, or digestive salt. The salt with excess of pure air crystallizes first, and by means of repeated crystallizations, is entirely disengaged from the other.

1487 Method of procuring a detonating salt from the acid in quantity.

## V. *Aqua Regia.*

1488 Various ways of preparing aqua-regia.

THIS acid, which is named from its property of dissolving gold, is compounded of the nitrous and marine acids. Gold and platina cannot be dissolved in any other menstruum, nor can regulus of antimony and tin be so easily dissolved by any other as aqua-regia. It may be made various ways. 1. By adding the two acids to each other directly. 2. By dissolving in the nitrous acid some salt containing marine acid, particularly sal ammoniac and common salt. 3. By distilling nitrous acid from either of these salts. And, 4. In Dr Priestley's method of impregnating marine acid with nitrous acid vapour.

1489 Differences between these acid liquors.

The only difference between those liquors prepared by the methods abovementioned is, that when sal ammoniac or sea-salt are dissolved in the nitrous acid, the aqua-regia contains a quantity of cubic nitre, or nitrous ammoniac, which, tho' it cannot much affect the acid as a solvent, may make a considerable difference in the nature of the precipitate. Thus, gold precipitated from an aqua-regia formed by the pure nitrous and marine acids, does not fulminate, though it does so when precipitated from one made with sal ammoniac. There are no established rules with regard to the proportions of nitrous and marine acids, or of nitrous acid and sal ammoniac, which ought to be employed for the preparation of aqua-regia. The common aqua-regia is made by dissolving four ounces of sal ammoniac in 16 ounces of nitrous acid; but these proportions must be varied, according to the nature of the intended solution.

Borax.

tion. Platina, for instance, is dissolved in the greatest quantity by equal parts of the two acids; regulus of antimony by four parts of nitrous acid to one of marine; and, in general, the greater the quantity of marine acid employed in the mixture, the less are the imperfect metals, particularly tin, calcined or precipitated by it. A mixture of two parts of spirit of nitre, and one of spirit of salt, dissolves nearly an equal weight of tin into a clear liquor, without forming any precipitate; but, for this purpose, the operation must be conducted slowly, and heat avoided as much as possible.

## VI. *Borax*.

1490 Methods of purifying borax.

In a memoir in Crell's Chemical Annals, by M. Tychson, the author shews, by different experiments, that it may sometimes be purified by solution, filtration, and evaporation only; but that sometimes the operation is more easy and effectual by previous calcination; but then the product is a little lessened, especially if the calcined mass be not well powdered, and then boiled sufficiently in water. Powder of charcoal, he says, may be sometimes advantageously employed in the purification; but in general there is no difference between the crude and purified borax, except in the addition of extraneous matters; at least, as the quantity of acids is the same, the addition of mineral alkali is useless: these extraneous matters are an animal fat, and a sand composed of clay, lime, and a martial earth. If the oily matter of tartar be separated by passing the lixivium through a stratum of clay, as is supposed in the preparation of the crystals at Montpelier, it would suggest a method of greatly abridging the process of the purification of borax.

## VII. *Acid of Borax, or Sedative Salt*.

1491 Methods of preparing the sedative salt from borax.

On the preparation of this salt Mr Beaumé observes, that a little more acid ought to be added to the borax than what is just sufficient to saturate its alkaline basis. Unless this be done, the sedative salt remains confounded with the other saline matters in the solution, and of consequence the crystallization must be disturbed. The salt, though formed in an acidulated liquor, is easily deprived of its superfluous acid by draining upon paper. It does not crystallize as soon as the stronger acid separates it from its basis, even tho' the solution of borax had been previously made as strong as possible; but this delay is occasioned by the heat of the liquor; for as soon as it cools, a considerable quantity of crystals is formed.

1492 Its properties.

The acid of borax does not fall into powder when exposed to the air, but rather attracts a little moisture from it. Its taste is at first somewhat sourish, then cooling and bitterish; and lastly, it leaves an agreeable sweetness on the tongue. It makes a creaking sound, and feels a little rough between the teeth; and when vitriolic acid is poured upon it, exhales a transient odour of musk. It is soluble, according to some chemists, in the proportion of one to 20 in cold water, or of one to eight in boiling water. Wenzel informs us, that 960 grains of boiling water dissolve 434 of the salt; while, on the other hand, Morveau asserts, that he could dissolve no more than 183 grains in a pound of distilled water. Rouss informs us, that fixed air prevents the solution of the salt in water; and Morveau, that its solubility is much augmented by cream of tartar. When previously made red hot, it dissolves in water with a smell of saffron, and a grey powder of an earthy appearance is precipitated, which is soluble in vitriolic and marine acids, and may be again precipitated in the form of sedative salt.

Acid of borax and its combinations.

Phlogisticated alkali makes no change on sedative salt in solution; but paper dipped in a solution of it in vinegar, and afterwards dried, burns with a green flame. It is capable of vitrification, though mixed with fine powder of charcoal; and with soot unites into a black mass like bitumen; which, however, is easily soluble in water, and can scarce be reduced to ashes, but partly sublimes. By the assistance of heat it dissolves in oils, especially those of the mineral kind; and with these it yields solid and fluid compounds, which gives a green colour to spirit of wine. Rubbed with phosphorus it does not prevent its inflammation; but a yellow earthy matter is left behind. It seems also to give to white and red arsenic a great degree of fixity, so as even to become vitrescible in the fire; and this property it communicates also to cinnabar. When mixed and heated with powder of charcoal, it forms no liver of sulphur.

### Sedative Salt combined,

1. *With volatile alkali.* The produce of this is a peculiar ammoniacal salt, which does not evaporate when thrown on burning coals, or otherwise intensely heated, but melts into glass of a greyish colour, but transparent, which cracks when exposed to the air; and, on dissolution in water, shoots into small crystals, which appear to have lost none of their alkaline basis. It may be decomposed by the acetous as well as the mineral acids, and by fixed alkalies and lime.

2. *With magnesia* this acid shoots into irregular crystalline grains soluble in vinegar and acid of ants; in which liquids they crystallize like small needles joined together at right angles. They are decomposed by all other acids, and likewise by spirit of wine. In the fire, however, they melt easily without any decomposition; and in the dry way sedative salt decomposes all the earthy salts formed by magnesia and any of the volatile acids.

3. *With pure earth of alum,* sedative salt forms a salt very difficult of solution, when one part of earth is ground with four times its weight of sedative salt and water. The same kind of earth, mixed with half its weight of sedative salt, forms a hard grey mass, resembling pumice stone; part of which is soluble in water, and yields a mealy sediment, together with some sedative salt unchanged.

4. *With siliceous earth* the sedative salt does not unite in the moist way; but, on melting one part of acid with two of this earth, we obtain a frothy, hard, greyish-white mass, from which, however, the acid may be again procured.

5. *Gold* is not acted upon in the wet way by acid of borax; nevertheless Rouss observed, that when sedative salt was melted with gold-leaf, it did not vitrify, but became frothy and hard, did not colour the flame of spirit of wine, and only a little of it was soluble in water in which sedative salt had been crystallized.

A

Acid of borax and its combinations.

A solution of borax in which sedative salt was dissolved, did not precipitate gold.

6. *Platina* is not precipitated from aqua-regia by sedative salt.

7. *Silver* is not affected by melting with an equal quantity of sedative salt; but the latter is vitrified in such a manner as to become insoluble in water.

8. *Mercury* is not dissolved either in the dry or wet way; but a solution of borax saturated with sedative salt precipitates it in a yellow powder from nitrous acid.

9. *With copper*. On this metal sedative salt acts but weakly, even when the solution is boiling hot; nevertheless, as much of the metal is dissolved, as gives a little white precipitate on the addition of fixed alkali; but volatile alkali does not throw down a blue precipitate, nor turn the solution of that colour. The solution of borax precipitates all solutions of copper in acids, and then the sedative salt unites with the copper in form of a light green jelly, which, after drying, is of very difficult solution in water. Bergman says, it is of an agreeable green colour, which it preserves after being dried; and that, when exposed to the fire, it melts into a dark-red vitreous substance. Wenzel asserts, that by long continued trituration of copper filings with sedative salt he obtained a solution of the metal, which yielded crystals on being evaporated. With twice its weight of copper in a covered crucible, an insoluble vitreous mass was obtained.

10. *Tin* is not apparently acted upon by boiling with sedative salt; nevertheless, the solution becomes turbid on the addition of an alkali. By melting the calx with half its weight of sedative salt, we obtain a black mass like the dark coloured tin ore. By rubbing for a long time filings of tin with sedative salt and water, and afterwards digesting the mixture with heat for one day, an hard, sandy, and irregularly shaped salt was obtained, which, by dissolution in water, yielded transparent, white, polygonous crystals; and a salt of of the same kind was obtained from the slag produced by melting equal parts of sedative salt and tin filings.

11. *Lead* is not acted upon directly; but, on adding a solution of borax to solutions of the metal in vitriolic, nitrous, marine, or acetous acids, the sedative salt unites with the lead. One part of sedative salt with two of minium gives a fine, greenish-yellow, transparent, and insoluble glass.

12. *With iron*. The acid of borax dissolves this metal more easily than any other. The solution is amber-coloured, and yields an ochry sediment, with clusters of yellow crystals containing a little iron. The metal is precipitated by borax from its solutions in vitriolic nitrous, marine, and acetous acids, and the precipitates are soluble in sedative salt. A solution of iron may also be obtained by melting this salt with iron filings, and lixiviating the mass.

13. *Zinc* communicates a milky colour by digestion with solution of sedative salt. By evaporation it affords a confused saline mass, and a white earthy powder by precipitation with alkali. Flowers of zinc, melted with sedative salt, form a light green insoluble slag.

14. *Bismuth*, in its metallic state, is not acted upon by sedative salt, but is precipitated by borax from a mixture of vitriolic and marine acids, in form of a very white powder, which keeps its colour when exposed to air, and melts in the fire to a white, transparent, and permanent glass.

Acid of borax and its combinations.

15. *Regulus of antimony* is not acted upon directly, but its calx is dissolved when precipitated by borax from a solution in aqua-regia.

16. *White arsenic* unites with sedative salt either in the dry or moist way, and forms a crystallizable compound, forming either pointed ramifications, or white, greyish, and yellowish saline powder.

17. *On regulus of cobalt* the acid has no direct action; but borax precipitates it from its solution, and the calx melts with the salt into a slag of a bluish-grey colour; and this, by lixiviation and evaporation, affords a sedative salt impregnated with cobalt, of a reddish white colour, and of a ramified form.

18. *Nickel* is precipitated from its solution, and the sedative salt unites with it into a saline substance difficult of solution.

A variety of opinions have been formed concerning the nature of sedative salt. M. Beaumé and M. Cadet particularly have made a great number of experiments on the subject; but as none of these have led to any certain conclusion, we forbear to mention them at present. Those of Messrs Exschaquet and Struve have indeed established some kind of relation between the acids of borax and phosphorus, and they have made several attempts to analize the former, but with little success. The most remarkable of these experiments are the following. 1. They distilled, with a strong heat, two parts of phosphoric acid evaporated to the consistence of honey, one of sedative salt, and two of water. Towards the end of the distillation a very acid liquor was obtained; and the residuum was a white earth, in quantity above three-fourths of the sedative salt employed, and which, on examination, was found to be the siliceous earth; the liquor which passed over into the receiver being found to be the volatile phosphoric acid. If, in this experiment, too much phosphoric acid be added, a greasy matter remains; and, if too little, a part of the sedative salt will remain undecomposed. In their attempts to compose borax, they combined phosphoric acid with mineral alkali, the result of which was a compound resembling borax in many respects. When exposed to the fire it melts into a very fusible glass, which has a mild taste, and seems neutral, but on exposure to the air, becomes moist and acid. On being saturated with alkali a second time and vitrified, it again deliquesces and becomes acid; and the more frequently this operation is repeated, the greater is the resemblance it bears to borax. In this experiment they supposed that the alkali was decomposed, and converted into an earth similar to that of sedative salt.

1493
Experiments made to determine the nature of the sedative salt.

With earthy substances the results were very remarkable. With earth of alum a crystallizable salt was obtained, which made paper burn with a green flame. Fixed alkali added to a solution of this salt precipitates an earth, and the salt then formed by crystallization resembles borax in several properties.— In the dry way the earth of alum, with the phosphoric acid, melts into a glass of the same fusibility as that of borax, and like it is fixed in the fire. The solution of this glass did not crystallize. Common clay

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Acid of amber.

clay digested with phosphoric acid produces silky crystals resembling sedative salt. When dried with their mother-water, these give a clear glass, which when united with mineral alkali, has the taste of borax, smells in the same manner, and has the same effect upon metals. With lime, magnesia, and terra ponderosa, this acid produces fusible glasses, insoluble in water, and which communicate a green colour to flame. Earth of bones and selenite mixed with the acid give a white, hard, shining glass, like the best crystal, but fusible as the glass of borax, and which continued flexible after it had ceased to be red-hot. Two parts of gypsum, with one of phosphoric acid, gave a milk white glass fit for soldering metals and enameling. In these experiments, however, it must be remembered, that unless the heat be raised very quickly, the phosphoric acid will be evaporated before any fusion takes place.

## VIII. *Acid of Amber.*

It was known to Agricola, that a particular kind of salt could be obtained from amber by distillation; but neither he, nor any succeeding chemist for some time ascertained its acid properties. On the contrary, some erred so far as to imagine that it was a volatile alkali; but, about the beginning of the present century, its acidity began to be generally acknowledged. This property indeed discovers itself by the taste, which is manifestly acid and empyreumatic, along with the peculiar flavour of amber. According to Scheele, also, the aqueous fluid which passes over in the distillation of amber, is an acid resembling vinegar both in taste and chemical properties; and which of consequence ought not to be confounded with the true acid of amber, which manifests qualities of a very different kind.

1494 Methods of purifying the salt of amber.

The properties of salt of amber can hardly be investigated until it has been purified; for which, of consequence, various methods have been proposed. Pott recommends crystallization, after having filtered the solution through cotton-wool, in order to retain the oil. Cartheuser attempts the purification by dissolving the impure salt in spirit of wine, then diluting with six times its quantity of water, and crystallizing the salt. Others recommend sublimation with common salt or sand, and Bergman with pure clay.

The salt of amber dissolves, by the assistance of heat, in nitrous and marine acids, and in the vitriolic without heat. In none of these combinations, however, does it either alter the dissolving acids, or suffer any alteration itself, except that it becomes whiter; with nitre it detonates and flies off; and if the quantity of salt of amber has been greater than that of nitre, the latter is alkalized. Stockar informs us, that it expels the marine acid from sal ammoniac, and sublimes before that salt; with which it does not form any union. When sublimed from common salt, it does not alter the latter in any other respect than giving it a darker colour. It precipitates calcareous earth from its solution in vinegar; and it decomposes sugar of lead; but the precipitate differs from plumbum corneum. It does not prevent the solution of lead in the acids of sea-salt and nitre; nor does it produce any sulphureous smell by calcination with charcoal. Hence it appears that it is neither a vitriolic, nitrous, nor marine acid; and M. Bourdelin must have been mistaken, when he affirms, that, after detonation of this salt with nitre, he obtained a residuum, which tasted like common salt, decrepitated in the fire, yielded crystals of a cubical form, precipitated silver and mercury from the nitrous acid; and thence concluded that it was the same with acid of sea-salt. It is very dear, as only about half an ounce can be obtained from a pound of amber.

Acid of amber and its combinations.

### Acid of Amber combined.

1. *With fixed vegetable alkali.* By saturating salt of amber with the fixed vegetable alkali, and then slowly evaporating the solution, we obtain, according to Wenzel, a light deliquescent saline mass; but, according to Stockar, whose experiments are confirmed by those of Mr Keir, the solution abovementioned affords shining white transparent crystals of a triangular prismatic figure, with the terminating points truncated. These crystals readily dissolve in water, deliquesce in the air, and have a peculiarly bitter saline taste. In the fire they decrepitate, melt, and remain neutral; though Wenzel has observed, that with an intense heat they are decomposed and become alkaline. These crystals do not change aquafortis into aqua-regia; and though they precipitate both the solutions of lead and silver, the precipitates are neither plumbum corneum nor luna cornea.

2. *With Mineral alkali.* This combination produces long three-sided columnar crystals, intermixed with some that are foliated. These crystals do not deliquesce in the air, and have a saline, bitter, and smoky taste. They are less soluble than common salt, and melt with more difficulty than nitre. They do not become alkaline on burning coals, and, in their other properties, resemble the former.

3. *With volatile alkali.* This salt shoots into acicular crystals, having a sharp, saline, bitter, and cooling taste; when heated in a silver spoon, they melt and evaporate entirely; in close vessels they sublime. They do not precipitate solution of silver, nor change spirit of nitre into aqua-regis. A powerful antispasmodic remedy is prepared from rectified spirit of hartshorn and salt of amber.

4. *With lime.* This shoots into oblong pointed crystals, which do not deliquesce in the air, and are soluble with difficulty even in boiling water; nor, according to Mr Stockar de Neuforn, can they be decomposed by distillation either with acetous or marine acids. They detonate by distillation with nitrous acid; and are decomposed, either in the moist or dry way, by the vitriolic. When mixed with common sal ammoniac in the dry way, they suffer a decomposition; the succinated ammoniacal salt flying off and the combination of marine acid with lime remaining behind.

5. *With magnesia.* This yields a white, gummy, frothy, saline mass, which acquires a yellowish colour when dried by the fire; and, when cool, deliquates in the air. It is decomposed by alkalies and lime, as well as by the vitriolic acid.

6. *With clay.* By uniting the acid of amber with an edulcorated precipitate of alum with vegetable alkali, Wenzel obtained prismatic crystals, which could not be decomposed by alkalies.

7. *With silver.* The acid of amber has no effect on silver

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Acid of amber and its combinations.

silver in its metallic state; but with its precipitate forms thin oblong crystals, radiated and accumulated upon one another, from which the silver may be separated by alkalies, by quicksilver, and by copper.

8. *With copper.* By a long digestion of copper with acid of amber a green solution is obtained, which by mixture with common salt is rendered turbid, by vitriolic acid white, and lets fall a green precipitate on the addition of fixed alkali. Wenzel, however, could not obtain this precipitation by alkalies. His solution yielded groups of green crystals, gave a crust of copper to zinc, and was precipitated by liver of sulphur.

9. *With iron.* Wenzel dissolved a precipitate of this metal in acid of amber, and from the solution obtained small, brown, transparent, and stellated crystals. Zinc precipitated the metal, but not alkalies. From a slightly coloured solution of metallic iron, Pott obtained, by means of alkali, a white precipitate, which soon became yellow, and at length green, by pouring water upon it.

10. *With tin.* Acid of amber dissolves tin when precipitated by a fixed alkali; and the solution yields thin, broad, and foliated transparent crystals. Alkalies throw down but little from this solution; liver of sulphur more; and lead, iron, or zinc, nothing.

11. *With lead.* Acid of amber whitens the surface of lead in its metallic state, but does not dissolve it; neither can lead be precipitated from its solutions in nitrous and marine acids by salt of amber, though this is denied by Pott. According to Stockar, however, it forms a white precipitate with sugar of lead. This metal precipitated by an alkali, and dissolved in acid of amber, forms long foliated crystals lying upon one another; from the solution of which the lead may be precipitated by alkalies in the form of a grey powder, and by zinc in its metallic state.

12. *Zinc*, in its metallic state, is readily dissolved by the acid of amber; and by a combination with the precipitate formed by fixed alkali, we obtain long, slender, foliated crystals, lying upon one another. The solution lets fall a white precipitate on the addition of fixed alkali; but this is denied by Stockar, who says that volatile alkali produces a red precipitate.

13. *Bismuth.* By means of heat, Stockar obtained a solution of this semimetal in acid of amber, which was decomposed by alkalies. Wenzel obtained, from a precipitate of bismuth prepared by means of fixed alkali, small, slender, foliated, and yellow crystals; which alkalies cannot decompose, though black precipitates are thrown down by lead and zinc.

14. *Regulus of antimony.* Little or none of this semimetal, in its reguline form, is dissolved in the acid of amber; but it attacks the precipitate made with fixed alkali. This solution is very copiously precipitated by liver of sulphur, but not by alkalies.

The combinations of this acid with gold, platina, nickel, arsenic, and manganese, have either been found impracticable, or not yet attempted; all those above described are non-deliquescent, and part with their acid when exposed to the fire. The elective attractions of this acid, according to Bergman, are singular, as it adheres more strongly, not only to terra ponderosa and lime, but to magnesia, than to fixed alkali.

On the origin of salt of amber, Mr Keir remarks, that "it deserves to be considered as a pure and distinct acid. No proofs have been adduced of its being a modification either of the marine or vegetable acids, as Mr Cornette and M. Hermbstadt have supposed. The former, having distilled spirit of salt with oil of lavender, obtained an acid which smelled like salt of amber, but on examination was found to retain the properties of the muriatic acid. He also relates, that, when purifying a considerable quantity of the salt of amber which he had prepared himself, some sea-salt was separated, which in the distillation had arisen along with it. But this observation cannot be justly applied to show any resemblance betwixt these two, any more than the smell in the former case could show an analogy betwixt it and oil of lavender. This mixture of sea-salt with acid of amber, however, may readily explain the mistake of M. Bourdelin already mentioned. M. Westrumb and M. Hermbstadt have both laboured in vain to convert the acid of amber into acids of sugar and tartar by frequent distillations with spirit of nitre; and their want of success confirms the account already given, that the acids of nitre and amber have no action upon each other, farther than that the former is phlogisticated or changed into red fumes, and the latter becomes whiter. Nevertheless, if Mr Scheele's observation of the identity of the acid liquor, which comes over in the distillation of amber with acetous acid, holds good, we shall have the best reason yet given to ascribe the origin of this acid to the vegetable kingdom; and when we consider the very different properties that are assumed by the vegetable acids, which, however, are convertible into one another, no reason can be drawn from the diversity of its properties with those of other vegetable acids, against its having a common origin with them. Indeed the natural history of amber, its similarity to gums and resins, and its involved insects, afford other arguments in favour of the opinion.

1495 On the nature of the acid of amber.

## IX. *Acid of Arsenic.*

1496 M. Pelletier's method of procuring the arsenical acid.

M. Berthollet remarks upon Mr Scheele's process, that during the operation a great quantity of dephlogisticated air is expelled from the acid. M. Pelletier has found another method of procuring the arsenical acid. He mixes common white arsenic with nitrous ammoniac, and distils the mixture. At first phlogisticated nitrous acid passes over, then the volatile alkali, and lastly the arsenical acid remains in the retort in form of a vitreous mass, which deliquesces into a very dense acid liquor, reddening syrup of violets, and effervescing with alkalies. Mr Macquer had formerly described this process, and observed, that the nitrous acid passes over first, and then the volatile alkali; but was of opinion that the residuum was nothing but arsenic. He mentions a detonation which took place in his experiment; but nothing of this kind was observed by M. Pelletier: he only informs us, that the nitrous acid was driven over with great violence, while that of arsenic united with the volatile alkali. M. Berthollet, who has endeavoured to ascertain the weight gained by the conversion of sulphur, phosphorus, and arsenic, into acids, determines that of arsenic to be about one-ninth of the whole. At the same time he observes, that this additional weight does not discover the whole weight of the air contained in the

Acid of molybdæna

the arsenic, as it had that necessary to convert it into calx before the operation of converting it into an acid was begun. On the other hand, M. Bergman asserts, that one-fifth of white arsenic is phlogiston, and that this calx is converted into acid merely by being deprived of its phlogiston. Thus the *facts* related by these two celebrated chemists differ enormously from one another; M. Berthollet affirming that the arsenic *gains* a ninth of its original weight in the process of acidification; and M. Bergman, that it *loses* a fifth part of the same. M. Berthollet endeavours to reconcile this, by supposing that Bergman had employed marine acid for the preparation of his arsenical acid, which is well known to cary off with it some part of most of those substances with which it is capable of combining; and to this he attributes the loss of weight in Bergman's process.

### IX. *Acid of Molybdæna.*

1497 M. Pelletier's experiments.

The opinion of M. Bergman concerning the metallic nature of the acid of molybdæna has obtained some confirmation from the experiments of M. Pelletier. He was not able indeed to obtain any regulus; but by means of oil alone he procured, by two hours vehement heat, a substance slightly agglutinated with a metallic lustre, containing small round grains of a grey metallic colour, very visible by the help of a magnifier. These he supposes to have been a true regulus of molybdæna; which he found to possess the following properties. 1. It is calcinable by fire into white calx. 2. It detonates with nitre, and the residuum is a calx of molybdæna united with the alkali of the nitre. 3. It is converted into a white calx by means of nitrous acid. 4. It yields inflammable air when treated with alkalies in the dry way, and forms peculiar compounds with them. 4. It forms regenerated molybdæna with sulphur. 6. It unites, and forms peculiar substances with metals. By uniting it with silver, iron, and copper, we have friable reguline masses; and refractory powders with lead and tin.

Our author, in consequence of his experiments, considers molybdæna as a metallic substance mineralized by sulphur; and the earth called the acid of molybdæna as a calx much dephlogisticated, which has retained part of the air contained in the nitrous acid. He observes likewise an analogy betwixt molybdæna and antimony in their chemical results. Both of them yield vitrifiable argentine flowers by similar operations, and both are changed into white earths by nitrous acid; but they differ in the two following respects. 1. The latter easily gives a fusible regulus; but the molybdæna seems to be the most refractory of all the semimetals. 2. The calx of regulus of antimony is soluble by alkalies in the moist way, but that of molybdæna is not.

### X. *Acid of Tungsten or Wolfram.*

1498 Properties of tungsten.

Mr Luyart, who has examined this mineral, gives the following account of it. 1. It is infusible by the blow-pipe, though the angles of the pieces into which it is broken are thereby rounded. 2. It effervesces with microcosmic salt, and melts before the blow-pipe into a reddish glass. 3. With borax it effervesces; and by the outward flame of the blow-pipe is changed into a reddish glass; by the internal flame into a greenish one. 4. Heated by itself in a crucible, it swelled, became spongy, semivitrified, and was attracted by the magnet. 5. With an equal part of nitre it detonated, or boiled up with a blue flame round the edges, and nitrous vapours arose. The mass was soluble in water, and let fall a white precipitate with acid. 5. It melted readily with fixed alkali, leaving a kind of black matter in the crucible, and a smaller quantity of lighter coloured substance on the filter. These residuums showed a mixture of iron and manganese. 6. With nitrous acid the filtered solution let fall a white precipitate, at first sweet, but afterwards bitterish and sharp, and which caused a disagreeable sensation in the throat; and the acidity of the solution of it was manifest, by its turning the tincture of turnsole red.

Acid of tungsten.

Having examined the substance by means of liquids in Mr Scheele's way, they obtained the same yellow powder which he had characterized as the acid of tungsten, along with a very small residuum, which appeared to contain a mixture of tin. Proceeding farther in the analysis, they found that wolfram is composed of manganese, calx of iron, the yellow matter called the *acid of tungsten* by Bergman and Scheele, with a very little mixture of quartz and tin, and which they considered as accidental.

1499 Of the yellow matter, called its acid by Mr Scheele.

They now proceeded to examine the yellow matter, supposed by the two celebrated chemists just mentioned to be a simple acid salt, but which turned out very different on their inquiries. In order to procure a quantity of it, they melted six ounces of wolfram with as much vegetable alkali, dissolved the mixture in distilled water, filtrated the liquor, and evaporated it to dryness. Thus they obtained a white salt; upon which, when dry, they poured nitrous acid, and set it to boil in a sand-bath; by which operation it became yellow. They then decanted the liquor, pouring fresh acid upon the residuum; and repeated the operation a third time in order to deprive it of all the alkali. The remaining powder was then calcined in a cupelling furnace under a muffle, when it came out quite pure and yellow. The properties of it were then found to be as follow. 1. It is entirely insipid, and of the specific gravity of 6.12. 2. Before the blow-pipe, it continues yellow in the exterior flame even though put on charcoal; but grows black and swells, though it does not melt, in the internal flame. 3. In the internal flame it forms a blue transparent glass with microcosmic salt. The colour vanishes in the external flame, but appears again in the internal one; but by a continuance of this operation, it at last loses its colour so much that it cannot be recovered. 4. It effervesces, and forms a brownish yellow transparent glass with borax, which keeps its colour in both flames. 6. When triturated with water, it forms an emulsion which passes through filters without becoming clear, and continues a long time without any deposition. 7. It is insoluble in acids, but dissolves readily in the vegetable alkali both in the moist and dry way; though the produce has always an excess of alkali. 8. On adding nitrous acid in greater quantity than what is necessary to saturate this excess, a white powder falls, which is the same with the acid of tungsten discovered by Mr Scheele; but which Messrs Luyarts will



not

not allow to be a simple acid, though they admit that it contains one; and affirm, that its properties are various according to the circumstances of its precipitation. The properties of it, as described by them, are the following. 1. It is fusible before the blow-pipe, exhibiting the same phenomena as the yellow matter. 2. By calcination in a little pot or test, it emits the smell of nitrous acid, and turns yellow; but, on cooling, remains white, insipid, and insoluble; and this residuum melts by itself before the blow-pipe. 3. A yellow colour is produced either by vitriolic or marine acids; and the filtrated liquor affords a neutral salt with basis of fixed alkali, according to the nature of the acid employed. If the vitriolic acid is employed, and the operation performed in a retort, a quantity of nitrous acid passes over. 4. If, instead of pouring the acid on the salt, it be poured upon its solution, no precipitate will be formed, not even by making the liquor boil, if the quantity of acid is small; only the solution loses its sweet taste, and acquires more bitterness. On pouring on a large quantity of acid, and causing the liquor boil, a yellow precipitate is formed in every respect similar to the yellow matter so often mentioned. 5. This salt is completely dissolved by the boiling with vinegar. On leaving the solution to cool, a white waxy matter adheres to the sides of the vessel; which being washed and kneaded with the fingers, forms an adhesive mass like bird-lime, having a fat and greasy taste. By exposure to the air it acquires a dark grey colour, loses its adhesive property, and becomes bitter. It dissolves in water; and gives at first a sweet, then a bitter taste, making the tincture of turnsole red. 6. On evaporating the alkaline solution to dryness, pouring acetous acid upon the residuum, and then making it boil, the greater part of the residuum, was dissolved, and on cooling afforded feathery crystals. These when edulcorated had a sweet taste, though less strong than that of the former salt, which afterwards became bitter. Their solution turned blue paper red; was precipitated, and became like an emulsion with spirit of wine; and the residuum, which did not dissolve, appeared to be of the same nature. The crystals dissolved in fresh acetous acid, and communicated a blue colour to the acid; but this gradually disappeared on cooling, and a glutinous matter was deposited on the sides of the vessel, which had the properties of the former substance of that sort. If, in place of letting the solution cool, it should be kept boiling, the blue colour disappears, and nothing is precipitated. By adding spirit of wine when the liquor is almost evaporated to dryness, a white powder is precipitated; which after being edulcorated with fresh spirit of wine, tastes exceedingly bitter, and is very soluble in water. This solution, however, does not redden blue paper, nor make a blue with vinegar. With vitriolic acid its solution is blue; with vitriol of copper it forms a white precipitate. All these salts, by calcination, first become blue, then yellow, and lastly white. 7. On pouring a quantity of lime-water upon the solution of the precipitate formed by the nitrous acid, as well as on those obtained by the acetous acid, white precipitates were formed, all of which were a true regenerated tungsten. Having afterwards impregnated the liquors with fixed air, and boiled them in order to precipitate the lime more completely, they found in the solutions, after they were filtrated and evaporated to dryness, neutral salts formed of the precipitating acids, joined with alkaline and calcareous bases. This proved, that both alkali and acid were concerned in the precipitation. 8. On pouring the vitriolic solutions of iron, copper, and zinc, as well as that of marine mercurial salt, alum, and Prussian alkali, upon the solution of the precipitate formed by the nitrous acid, no precipitation ensues, and the acetous salts of copper and lead give white precipitates; but the Prussian alkali forms no precipitate with the acetous salts. Hence it appears that this salt is not a simple acid, but rather a salt composed of the yellow matter, fixed alkali, and the precipitating acid; and its composition appears more fully from the following experiments with the volatile alkali.

1500 No simple acid procurable from tungsten.

1. The yellow powder dissolves entirely in volatile alkali, but without any perfect saturation taking place; and the alkali always prevails. 2. The solution being set in a sand-bath, produced needle-like crystals, which had a sharp bitter taste, exciting a disagreeable sensation in the throat. Their solution turned the tincture of turnsole red, and the liquor from which they were crystallized had the same properties. 3. Having repeated this operation with different quantities of the same crystals, leaving some longer on the fire than others, solutions were obtained, whose acidity was in proportion to the time they had remained on the fire; but during the operation they all emitted the smell of volatile alkali. By calcination this alkali was entirely dissipated, and the residuum was a yellow powder, perfectly similar to that with which the operation was begun. On making use of a retort for the operation, the remaining powder was blue. 4. This salt precipitates the vitriolic salts of iron, copper, zinc, and alum, calcareous nitre, marine mercurial salt; the acetous salts of lead and copper; and with lime-water regenerates tungsten. The vitriolic acid decompounds it, and forms a blue precipitate; the nitrous and marine acids produce a yellow; but no precipitate is occasioned by the Prussian alkali.

Having poured nitrous acid upon a portion of the solution with excess of alkali, a white powder was precipitated, which, after edulcoration, had a taste at first sweet, but afterwards sharp and bitter, and its solution turned the tincture of turnsole red. This, on examination, appeared to be a triple salt formed of the yellow powder, volatile alkali, and the precipitating acid.

1501 A kind of semimetal procurable from tungsten.

The following experiments realize the conjecture of Bergman, that the acid of tungsten is the basis of a particular semimetal.

1. "Having kept 100 grains of the yellow powder (says M. Luyart) in a Zamora crucible well covered, and set the whole in a strong fire for half an hour, it became a spongy mass of a bluish black colour, the surface of which was crystallized into fine points, like plumose antimony, and the inside compact, and of the same colour. It was too hard to be broken in pieces by the fingers; and, when ground, was reduced to a dark-blue colour.

2, "Having mixed 100 grains of the same powder with 100 of sulphur, and put the mixture in a Zamora crucible on a strong fire for a quarter of an hour, it came out a dark-blue mass, which was easily broke by the

Acid of tungsten.

the fingers; and the inside presented a crystallization like needles as the last, but transparent, and of the colour of a dark lapis lazuli. This mass weighed 42 grains, and when placed on burning coals yielded no smell of sulphur.

3. "Having put another 100 grains of this powder into a Zamora crucible, provided with charcoal, and well covered, and placed it in a strong fire, where it remained an hour and a half, we found, on breaking the crucible after it was cool (A), a button, which fell to powder between the fingers. Its colour was dark brown; and on examining it with a glass, there was seen a congeries of metallic globules, among which some were the bigness of a pin's head, and when broke had a metallic appearance at the fracture in colour like steel. It weighed 60 grains: of course there was a diminution of 49. Its specific gravity was 17.6. Having calcined part of it, it became yellow, with $\frac{24}{100}$ increase of weight. Having put one portion of this substance powdered, in digestion with the vitriolic acid, and another with the marine acid, neither of them suffered more diminution than $\frac{2}{100}$ of their weight; then decanting the liquor, and examining the powder with a glass, the grains were still perceived of a metallic aspect. Both the acid liquors gave a blue precipitate with the Prussian alkali, which let us know that the small diminution proceeded from a portion of iron which the button had undoubtedly got from the powder of the charcoal in which it had been set. The nitrous acid, and aqua-regia extracted likewise from two other portions the ferruginous part; but besides, they converted them into yellow powder, perfectly similar to that which he used in this operation.

4. "Having put 100 grains of gold and fifty of the yellow powder in a Zamora crucible furnished with charcoal, and kept in a strong fire for three quarters of an hour, there came out a yellow button which crumbled in pieces between the fingers; the inside of which showed grains of gold, separated from others of a dark-brown colour. This demonstrated there had not been a perfect fusion and likewise that this substance was more refractory with gold, since the heat which it endured was more than sufficient to have melted it. The button weighed 139 grains; of course there was a diminution of 11 grains. Having put this button with lead in the cupelling furnace, the gold remained pure in the cupel; but this operation was attended with considerable difficulty.

5. "Having made a mixture of platina and yellow powder in the preceding proportions, and exposed it to a strong fire, with the same circumstances, for an hour and a quarter, it produced a button which crumbled with ease between the fingers, and in which the grains of platina were observed to be more white than usual, and some of them changed sensibly in their figure. This button weighed 140 grains, and of consequence there had been a loss of 10 grains. When calcined, it took a yellow colour, with very little increase of weight; and after washing it to separate the platina, there remained 118 grains of a black colour. Having placed this portion again to calcine over a strong fire in a muffle, it suffered no sensible alteration in weight or colour; for it neither grew yellow, nor took the brown colour of the platina, but kept the same blackness as before it was calcined. It must be attended to, that in the washings there was not so much care taken to collect all the platina as to deprive it of the yellow colour, and for this reason the water carried off part of the fine black powder: and consequently the increase which the platina preserved, after being washed and calcined the second time, ought to be computed more than the 18 grains which it showed by its weight.

"Having mixed the yellow powder with other metals in the preceding proportions, and treated them in the same manner, the result was as follows:

6. "With silver it formed a button of a whitish-brown colour, something spongy, which with a few strokes of a hammer extended itself easily, but on continuing them split in pieces. This button weighed 142 grains, and is the most perfect mixture we have obtained, except that with iron.

7. "With copper it gave a button of a copperish red, which approached to a dark brown, was spongy, and pretty ductile, and weighed 133 grains.

8. "With crude or cast-iron, of a white quality, it gives a perfect button, the fracture of which was compact, and of a whitish brown colour: it was hard, harsh, and weighed 137 grains.

9. "With lead it formed a button of a dull dark-brown, with very little lustre; spongy, very ductile, and splitting into leaves when hammered: it weighed 127 grains.

10. "The button formed with tin was of a lighter brown than the last, very spongy, somewhat ductile, and weighed 138 grains.

11. "That with antimony was of a dark-brown colour, shining, something spongy, harsh, and broke in pieces easily: it weighed 108 grains.

12. "That of bismuth presented a fracture, which, when seen in one light, was of a dark-brown colour, with the lustre of a metal; and in another appeared like earth, without any lustre: but in both cases one could distinguish an infinity of little holes over the whole mass. This button was pretty hard, harsh, and weighed 68 grains.

13. "With manganese it gave a button of a dark bluish-brown colour and earthy aspect; and on examining the internal part of it with a lens, it resembled impure drops of iron: it weighed 107 grains."

## XI. *Acid of Ants.*

Etmuller is among the first authors who mentions the existence of this acid, and speaks of obtaining it by distillation. Nothing of its properties, however, was known, until Margraaf undertook to examine it; of whose experiments we have an account in the Memoirs of the Berlin Academy for 1749. Since his time a number of chemists have prosecuted the subject to,

(A) "The first time we made this experiment, we broke the crucible without letting it cool entirely; and as soon as the matter was in contact with the air, it took fire, and its dark brown colour turned instantly yellow."

Acid of ants.

to a considerably greater length; but Mr Keir prefers the researches of Arvidson, Bucholtz, and Hermbstadt, to the rest.

The acid in question is a natural juice which the insects discharge when irritated, and which is very pungent to the smell as well as taste. Thus it may instantly be perceived on turning up an ant-hill in spring or summer. The *formicæ rubræ* of Linnæus are those insects which have hitherto supplied this acid. Mr Arvidson advises to collect them in the months of June and July, by laying some smooth sticks upon an ant-hill; which being then disturbed, the ants will run upon the sticks in great numbers, and may then be swept off into a vessel containing water until it be full. Hermbstadt collects them in the same manner, but into a dry bottle, to avoid the evaporation of the superfluous liquid. Bucholtz having moistened the inside of a narrow necked glass bottle with honey and water, sunk it into a disturbed ant-hill until the mouth was level with the ground; on which the insects, allured by the smell of the honey, went into the bottle, and could not get out.

1502 Different methods of obtaining this acid.

For obtaining the acid, Margraaf employed distillation, with the addition of fresh water. Thus he obtained, from 24 ounces of fresh ants, 11 ounces and two drachms of acid, some volatile alkali, empyreumatic oil, and a residuum containing earth and fixed salt. Arvidson made use of two methods: One consisted in distilling the ants when dry; from a pound of which, in this state, he obtained eight ounces of acid besides the empyreumatic oil. His other method was to inclose, in a piece of linen, the ants previously cleaned by washing in water, then to pour boiling water upon them, and to repeat the operation until it could extract no more acid; which is then obtained by squeezing the linen, mixing all the liquors, and filtering them. Thus from a pound of ants he obtained a quart of acid liquor, which tasted like vinegar, but was specifically heavier. By distillation Hermbstadt obtained from a pound of dry ants ten ounces and a half of yellow empyreumatic liquor, which did not taste more strongly acid than the spirit obtained by distilling wood, on which swam three drachms of a brown fetid oil, in all respects like that of hartshorn. In the retort was left a black residuum weighing one ounce six drachms, which exhibited signs of containing volatile alkali. By distilling a pound of ants with three of water, according to Mr Margraaf's method, he obtained an acid liquor and some oil in the receiver; and from the surface of that which remained undistilled, he collected a drachm and an half of fat oil.

The specific gravity of the acid liquor obtained by Mr Arvidson's maceration was 1,0011; that of the same liquor, when distilled, 1.0075; and of the acid concentrated by freezing, 1.0453. According to Bucholtz, the acid liquor thus obtained by maceration did not grow in the least mouldy in the space of four weeks; during which it was allowed to rest in order to free itself perfectly from the impurities it contained. Mr Hermbstadt, however, prefers Margraaf's method of distillation to that of Arvidson's macerations, not only as being a more perfect analysis, but as less laborious; though he finds fault also with Margraaf's method, as diluting the acid too much, and altering it so that it has not the smell of living ants. He totally disapproves of the method of distilling dried ants, as the acid is thus in a great measure decomposed, and the remainder united with much oil. To avoid all these inconveniences, he contrived another method, namely, to express the juice of the insects; by which means he obtained at once a concentrated liquor fit for distillation. In this way he obtained from two pounds of dried ants 21 ounces and two drachms of juice, which had a pungent and highly acid smell, resembling the vapours of fluor acid; in taste resembling concentrated vinegar and acid of tartar; to which last it might be compared for strength of acidity. By distilling eight ounces of this expressed liquor, he obtained six ounces and a half of clear acid, equal in strength to a very concentrated vinegar.

1503 Properties of the pure acid.

The acid, when thus procured in purity, has a pungent, not unpleasant smell, a sharp, caustic taste, and an agreeable acidity. It reddens blue paper, syrup of violets, and litmus; blackens the vitriolic acid, and converts part of it into a sulphureous vapour. It is also decomposed by distillation with nitrous acid. Spirit of salt likewise, when dephlogisticated, decomposes it, but not in its ordinary state. It does not form sulphur by an union with phlogiston, but produces inflammable vapours by dissolving iron or zinc. By the assistance of a gentle heat it dissolves soot, but oils with much more difficulty, and powder of charcoal not at all. It does not unite with vitriolic ether; but in distilling a mixture of this acid with spirit of wine, Mr Arvidson saw some traces of an ether, and M. Bucholtz perfectly succeeded in making an ether by means of it. It unites with fixed alkali, forming, according to M. Margraaf, a neutral salt, consisting of oblong deliquescent crystals, from which very little acid could be procured by distillation *per se*, but on adding concentrated oil of vitriol, a very strong and pure acid was obtained; from a mixture of which with spirit of wine, M. Bucholtz readily obtained a true ether. With mineral alkali it forms deliquescent foliated crystals of a saline bitter taste, and soluble in twice their weight of water. With volatile alkali it forms an ammoniacal liquor; which, according to Arvidson, cannot be brought into a dry state; but Mr Arvidson says he has obtained crystals from it, though very thin and deliquescent. Margraaf obtained dry crystals by uniting this acid, with chalk or coral; and Arvidson observes that this salt is transparent, cubical, or rhomboidal, nondeliquescent, soluble in eight parts of water, of a bitter taste, and insoluble in spirit of wine. No acid can be obtained from it by distillation *per se*. From a solution of magnesia in this acid, Mr Arvidson obtained some saline particles by deposition, and afterwards an efflorescence of transparent salt rising round a saline mass. This salt had scarcely any taste, was soluble in 13 parts of water, and insoluble in spirit of wine. With ponderous earth the acid formed a cluster of bitter needle-like crystals, which did not deliquesce, were soluble in four times their quantity of water, insoluble in spirit of wine, and when burnt gave out a smell like that of burnt sugar, leaving a coal which effervesced with acid. It unites with difficulty to the earth of alum, and can scarcely be saturated with it. It does not precipitate silver, lead, or mercury, from their solution, in nitrous acid; whence it seems to have no affinity to the marine

Acid of apples.

rine acid: and as it does not precipitate lime from the marine acid, it seems to have as little with the vitriolic. From his experiments, however, Margraaf concluded, that the acid of ants, in many respects, though not in all, has a great affinity with the acetous acid. From this it is distinguished by forming different compounds, and likewise by having different affinities. It dislodges the acetous acid also in all instances, and the arsenical acid from cobalt and nickel. It has a greater attraction for fixed alkalies than for lime.

1504 Has an affinity with the acetous acid.

1505 Its effects on metals.

As a solvent it acts but weakly upon copper; not at all, or very little, on silver, lead, tin, regulus of antimony, or bismuth, but strongly on iron or zinc. It dissolves, however, the calces of copper, silver, zinc, and lead, without affecting those of tin, regulus of antimony, or bismuth. The calx of quicksilver, according to Margraaf, is revived by it. According to Arvidson, it crystallizes with iron, zinc, or lead; does not act upon the regulus of antimony, of arsenic, cobalt, or nickel; though it dissolves their calces as well as the precipitate of manganese. Gold, mercury, and the calx of platina, are not affected by it; but it crystallizes with those of copper, silver, lead, bismuth, and mercury.

1506 Acid procured from various insects.

In its strength of attraction, the acid of ants exceeds those of vinegar, borax, and the volatile sulphureous and nitrous acids. Insects armed with stings, as bees, wasps, and hornets, are likewise said to discharge a very acid juice when irritated; and Mr Bonnet has observed a very strong acid ejected by a caterpillar which he distinguishes by the name of *grande chenille du saule a queu fourchue*. None of these, however, have been as yet particularly examined.

## XII. *Acid of Apples.*

That the juices of unripe fruits contain some kind of acid has been universally known, and attempts to investigate the nature of it have been made some time ago: but it is to Mr Scheele that we owe the discovery of the particular acid now treated of. He had observed that the juice of citrons contained a particular acid; which, by being united with lime, formed a salt very insoluble in water; and which therefore by means of lime could be readily separated from the mucilaginous part of the juice. By adding vitriolic acid to this compound of lime with the acid juice, almost in the same manner in which he used to procure the acid of tartar, the lime was again separated, and the pure acid of citrons obtained. Proceeding in the same manner with other fruit, he found that an acid, agreeing in every respect with that of citrons, could be procured from the juice of the *ribes grossularia*. Examining the juice which remained after the separation of the former acid from the citrons, he found that it still contained another acid; which being saturated with more calcareous earth, formed a salt easily soluble in water, and therefore remained suspended in the juice. To separate this new salt, he added some spirit of wine, by which the salt was precipitated; but finding that it still contained much gummy matter, he judged that it would be proper to attempt a separation of this gum before he precipitated the salt. For this purpose he evaporated some of the juice of the ribes grossularia to the consistence of honey, dissolving the mass afterwards in spirit of wine. Thus the acids, which are soluble in the spirit, were easily separated by filtration from the insoluble gum. He then evaporated the spirit, adding to the remainder twice its quantity of water, with as much chalk as was necessary for the saturation. The liquor was next boiled for two minutes; during which the insoluble salt was precipitated, and the liquor separated from it by filtration contained the solution of chalk in the new acid. To this solution he added spirit of wine, which again precipitated the salt, while some saponaceous and saccharine matters remained dissolved in the spirit.

1507 Acid of citrons how procured.

1508 Another acid procured from the juice of fruits.

1509 Its properties.

Having thus at last obtained the salt in a state of purity, he proceeded to examine its nature; and found, 1. That some of it, spread on his nail, soon dried, and assumed the appearance of varnish. 2. It was very soluble in water, and turned litmus red. 3. When the solution had stood some days exposed to air, it was found to have deposited a number of small crystals, which could only be dissolved by a quantity of boiling water; and this salt was also found to be completely neutralized, so that, it yielded its calcareous earth to a fixed alkali. 4. The salt was decomposed by heating *per se* in a crucible, and left a mild calcareous earth. 5. The acid was separated from the earth by adding oil of vitriol diluted with water until gypsum was no longer precipitated, and the new acid was left disengaged, so that it could be separated by filtration. 6. By this operation, however, all the lime was not precipitated; so that the separation of the acid was not complete. 7. He observed that the acid had a greater attraction for lead than for lime; and therefore made use of the method he had formerly discovered for separating the acid of sorrel. To the acid he added a solution of sugar of lead; by which the acid was precipitated along with the lead, and the vinegar was left in the liquor. To this precipitate, cleaned from the acetous acid by filtration, he added vitriolic acid, which expelled the weaker vegetable one, and thus left it quite pure and free from any heterogeneous mixture.

1510 How procured in perfect purity.

The juice of apples, either ripe or unripe, was found to contain no acid of citrons, but a large quantity of the new acid; which, being thus alone, he could more easily procure by a single operation. The best method of procuring this he found to be by saturating the juice of the apples with a solution of fixed vegetable alkali, and pouring a solution of sugar of lead to that of the salt just mentioned. The effect of this was a double decomposition, and a precipitate of lead combined with the new acid. To the edulcorated precipitate he then added a dilute vitriolic acid till he could no longer perceive any sweet taste in the liquor; for the first portions of the vitriolic acid dissolve a part of the calx of lead, and impart a sweetish taste to the liquor, which is sensible, notwithstanding its acidity; but when the quantity of vitriolic acid is sufficient to saturate the whole of the calx, all the metal falls to the bottom, and the sweetness ceases; so that the acid is at once obtained pure.

1511 Properties of it when obtained from the juice of apples.

The acid of apples is possessed of the following properties. 1. It cannot be crystallized, but always remains in a liquid state; or, if much evaporated, attracts the moisture of the air. 2. With fixed alkalies

Acid of apples.

of all kinds it forms deliquescent salts. 3. With calcareous earth it forms small irregularly shaped crystals, which cannot be dissolved but in a large quantity of boiling water; but if the acid is superabundant, the salt readily dissolves in lime-water. 4. It is effected by ponderous, earth in the same manner as by lime. 5. Earth of alum forms, with the acid of apples, a salt not very soluble in water. 6. With magnesia the acid forms a deliquescent salt. 7. Iron is dissolved into a brown liquor, which does not crystallize. 8. The solution of zinc affords fine crystals. 9. On other metals it has no remarkable effects. From the acid of citrons it differs. 1. The acid of citrons shoots into fine crystals. 2. The acid of apples can be easily converted into that of sugar, which Mr Scheele could not accomplish with that of citrons; though Mr Westrumb has since done it. 3. The salt formed with the citron acid and lime is almost insoluble in water; but that with acid of apples and lime is easily soluble. 4. Acid of apples precipitates mercury, lead, and silver from their solution in nitrous acid, and likewise the solution of gold, when diluted with water; but the acid of citrons does not alter any of these solutions. 5. The acid of citrons seem to have a greater attraction for lime than that of apples.

1512
Produced from sugar by means of nitrous acid.

It is remarkable that this acid is the first produced in the process for making sugar. If a diluted acid of nitre be drawn off from a quantity of sugar until the mixture becomes a little brown, which is a sign that all the nitrous acid is evaporated, the syrup will be found to have acquired a sourish taste; and if, by means of lime, we next separate all the acid of sugar, another will still remain, which dissolves the calcareous earth. When this acid is saturated with chalk, and the solution filtered and mixed with spirit of wine, a coagulation takes place. On separating the curdled part by means of a sieve, dissolving it in water, and then adding some vinegar of lead, the clax of lead will be precipitated; and if the new acid is then separated from the metal by means of diluted oil of vitriol, it will be found to possess all the properties of the acid of apples, and is indeed the same. The spirit of wine, which has been employed to precipitate the calcareous salt, leaves on evaporation a residuum of a bitter taste, very deliquescent, and similar to the saponaceous extract of the citron.

1513
Experiments with nitrous acid on various substances.

The following are the results of Mr Scheele's experiments with the nitrous acid upon different substances. 1. From gum arabic he obtained both the acid of apples and of sugar. 2. The same products were obtained from manna. 3. From sugar of milk he obtained not only its own peculiar acid, but those of apples and sugar. 4. Gum tragacanth, during its solution in nitrous acids, lets fall a white powder, which was found to be the acid of the sugar of milk. This gum contained also the acid of apples and of sugar, and a salt formed from lime and the acid of apples. 5. Starch left an undissolved matter; which being separated by filtration, and washed, resembled a thick oil like tallow, which, however, was found to be very soluble in spirit of wine. By distillation he obtained from this oily matter an acid similar to that of vinegar, and an oil which has the smell of tallow, and congeals by cold; and, besides these substances, he found that starch yielded the acids of apples and sugar. 6. From the root of salep he obtained the acid of apples, with a large quantity of calcareous saccharine salt. 7. Extract of aloes indicated the existence of the acids of sugar and apples, and lost the greatest part of its bitter taste. During the digestion a resinous matter was separated, which smelled like flowers of benzoin, and took fire on being heated in a retort. 8. Extract of colocynth was converted by nitrous acid into a resinous substance, and showed some signs of containing acid of sugar. 9. The extracts of Peruvian bark and of the other plants examined by Mr Scheele, gave both the acids of apples and sugar. 10. These two acids were likewise obtained from an infusion of roasted coffee, evaporated to the consistence of a syrup. 11. The same products were obtained from an extract of rhubarb, which yielded also a resinous matter. 12. Juice of poppies afforded the same results. 13. Extract of galls did the same. 14. The essential oils afforded little or none of the acids; but the oil of parsley-seeds seemed to be entirely convertible into them. 15. With a very concentrated acid he was able also to decompose animal substances. From glue he thus obtained fine crystals of acid of sugar, and afterwards acid of apples. Isinglass, whites and yolks of eggs, afforded the same products. From all these substances, especially the last, a fat matter was separated: but it was remarkable that the gas, expelled during the process, was composed of a little fixed air, a great quantity of phlogisticated air, and very little nitrous air, whereas no phlogisticated air is obtained in the usual process for preparing acid of sugar. He observed also that in the process for this acid, a small quantity of vinegar is found in the receiver. He could not obtain the acid of sugar from the saponaceous extract of urine; but got instead of it a salt, which, when completely purified, resembled exactly the flowers of benzoin. The same salt is precipitated in abundance by adding to the extract of urine a little vitriolic or marine acid; and Mr Scheele had already remarked that the same salt is obtained in the distillation of sugar of milk. 1514

Of the nature of this acid.

From the various experiments which have been made on this acid, it seems, according to Mr Keir, to be in an intermediate state betwixt acid of tartar and acid of sugar. This, however, ought not to prevent it from being accounted a separate and distinct acid, otherwise we might confound all the vegetable acids with one another. It approaches more nearly to the nature of acid of milk than of any other. From this also, however, it is distinguished, because the salt formed by the union of acid of milk with lime is soluble in spirit of wine, but not that from lime and the acid of apples. According to Mr Hermbstadt, if three parts of smoking nitrous acid be abstracted from one part of sugar, and if the brown acid mass which remains in the retort be diluted with six times its weight of distilled water, and saturated with chalk, two compounds will be formed; one consisting of the acids of tartar and lime, which will precipitate; and the other of lime and the acid of apples, which will remain suspended. If the calcareous earth be precipitated from this latter solution by adding acid of sugar, a pure acid of apples will be left in the liquor: and

Acetous acid.

and he further informs us, that this acid of apples may be changed entirely into those of sugar and vinegar, by means of strong nitrous acid.

### XIII. *Acetous Acid.*

1515 How to crystallize spiritus Mindereri.

It is generally believed, that the combination of this acid with volatile alkali is altogether incapable of crystallization; but Scheffer and Morveau inform us, that it may be reduced into small needle-shaped crystals, when the spiritus Mindereri is evaporated to the consistence of a syrup, and left exposed to the cold. The salt has a very sharp and burning taste, but a considerable quantity is lost during the evaporation. Westendorf, by adding his concentrated vinegar to volatile alkali, obtained a transparent liquor which did not crystallize. By distillation it went over intirely into the receiver, leaving a white spot on the retort. A saline transparent mass, however, appeared in the receiver under the clear fluid. On separating it from the liquid, and exposing it to a gentle heat, it melted, threw out white vapours, and in a few minutes shot into sharp crystals resembling nitre. These remained unchanged in the cold; but when melted with a gentle warmth, smoked and evaporated. Their taste was first sharp and then sweet.

1516 Salt from the acetous acid combined with calcareous earth.

The salt formed by uniting acetous acid with calcareous earth has a sharp bitter taste, and shoots into crystals somewhat resembling ears of corn. These do not deliquate in the air, unless the acid has been superabundant. They are decomposed by distillation *per se*, the acid coming over in white inflammable vapours smelling like acetous ether, somewhat empyreumatic, and condensing into a reddish brown liquor. By rectification this liquor becomes very volatile and inflammable; on adding water, it acquires a milky appearance, and drops of oil seem to swim upon the surface; a reddish brown liquor, with a thick black oil, remain after rectification in the retort. On mixing this calcareous salt with that of Glauber, a double decomposition takes place; we have a gypsum and the mineral alkali combined with acetous acid. By calcination, the mineral alkali may be obtained from this salt in a state of purity. This acetous calcareous salt is not soluble in spirit of wine.

1517 With magnesia.

On saturating this acid with magnesia, and evaporating the liquor, we obtain a viscid saline mass like mucilage of gum arabic, which does not shoot into crystals, but deliquesces in the air. It has a sweetish taste at first, but is afterwards bitter. It is soluble in spirit of wine, and parts with its acid by distillation without addition.

1518 With zinc.

Acetous acid dissolves zinc both in its metallic and calciform state, and even when mixed with other metals. By concentrated vinegar the zinc is dissolved with great heat, sulphureous smell, and exhalation of inflammable matter. By this union we obtain a congealed mass, which on dilution with water shoots into oblong sharp crystals at the first crystallization, and afterwards into crystals of a stellated form. From this liquor indeed crystals of various forms have been obtained by different chemists. Monnet obtained from it a pearl-coloured salt in friable talky crystals; which when thrown on the coals, fulminated a little at first, and gave a bluish flame, and then melted, letting its acid escape, while a yellow calx remained. Hellot informs us, that this salt by distillation *per se* in water, affords an inflammable liquor, and an oil at first yellow and then green, with white flowers burning with a blue flame. Westendorf obtained no oil in this distillation, but some acetous acid; a sweet-tasted empyreumatic liquor impregnated with zinc; sweet flowers, or sublimate, soluble in water, and burning with a green flame. On applying a stronger heat, the zinc was sublimed in its metallic form, leaving a spongy coal at the bottom of the retort. The solution gives a green colour to syrup of violets, lets fall a white precipitate on the addition of alkalies or an infusion of galls. It is not precipitated by common salt, vitriolated tartar, vitriolic or marine acids, blue vitriol, or corrosive sublimate; but forms a red precipitate when added to a solution of gold; a white precipitate with solution of silver; a crystalline pearly precipitate with solution of mercury; and crystalline precipitates with solutions of bismuth and tin. Acacording to Bergman, it is decomposed by acid of arsenic.

1519 Its phenomena with arsenic.

Though regulus of arsenic is not soluble in this acid, its calx may be dissolved either in common or distilled vinegar. M. Cadet obtained a smoking liquor by distillation from a mixture of white arsenic and terra foliata tartari. This experiment has been repeated by the chemists of Dijon, and attended with the following curious circumstances. "We digested (say they), in a sand-bath, five ounces of distilled vinegar on white pulverized arsenic; the filtrated liquor was covered, during evaporation, with a white saline crust. Of this substance were formed 150 grains; on which fixed alkali appeared to have no effect, and which was at first considered as pure arsenic. However, a cat, which had swallowed 72 grains of it, was only affected with vomitings that day and the next, and afterwards perfectly recovered. A similar dose was given to a little dog; but as he ran away, the effect it had upon him could not be discovered; but he returned afterwards in good health, and never showed any uneasiness: whence it may be concluded, that vinegar is in some measure an antidote against the pernicious qualities of arsenic.

1520 Vinegar supposed to be an antidote against arsenic.

"On redissolving this saline crust in pure water, filtering and mixing it with liquid alkali, an irregularly crystallized salt was formed in it after a few days standing. By this salt a yellow precipitate was thrown down from the nitrous solution of silver; whereas the solution of arsenic and terra foliata tartari threw down a white one.

"Equal parts of terra foliata tartari and arsenic, distilled in a retort, gave first a small quantity of limpid liquor with a penetrating smell of garlic, and which had the property of reddening syrup of violets; while solution of arsenic in water turns that syrup green. The vinegar which now arose was not saturated when arsenic, but effervesced strongly with fixed alkali, with which it became turbid, but did not let fall any precipitate. On changing the receiver, there came over a reddish brown liquor, accompanied with thick vapours, diffusing an intolerable smell, in which that of arsenic could scarcely be distinguished. On continuing the operation, a black powder sublimed into the neck of the

Acetous acid.

the retort, together with a little arsenic in its metallic form, and a matter which took fire by a lighted candle like sulphur.

"The red liquor still preserved its property of smoking though cold; diffusing at the same time its peculiar and abominable fetor, from which the apartment could scarcely be freed in several days. This liquor does not alter the colour of syrup of violets, but effervesces slightly with fixed alkali, letting fall at the same time a yellow precipitate, which, however, disappeared on an attempt to separate it by filtration.

1521 Curious phosphoric liquor.

"M. Cadet had observed, that the smoking liquor of arsenic did not kindle at the approach of a lighted candle; but that, on pouring it from the receiver into another vessel, it had kindled the fat lute with which the junctures had been closed, and which had been dried during the operation: but we, being desirous of examining more fully the nature of the red liquor which collects at the bottom, and has the appearance of oil, having decanted that which swims on the top, and poured the remainder on a filter of paper, before many drops had passed, there arose a thick smoke forming a column from the vessel to the ceiling; a slight ebullition was perceived at the sides of the vessel, and a beautiful rose-coloured flame appeared for a few moments. The paper filter was burnt at one side, but most of it was only blackened. After the flame was extinguished, a fat reddish matter remained: which being melted on burning coals, swelled considerably, emitting a white flame. It then sunk, and left on the coal a black spot, which could not be effaced but by the most vehement fire.

"At the time these observations were made, the liquor had been distilled for three weeks, and the bottle frequently opened. The inflammability could not proceed from the concentration of the vinegar: for the rose-colour of the flame, the precipitation of the sublimate, and the fixity of the spot remaining on the coal, evidently showed that the two substances were in a state of combination; which is also further evinced by the loss of the inflammable property when the liquor was decomposed by fixed alkali.—The smell of the liquor, however, though so intolerably fetid, was attended with no other inconvenience than a disagreeable sensation in the throat, which further strengthens the suspicion that vinegar is an antidote against arsenic.

"The saline brown mass remaining in the retort was partly dissolved by hot water; and the filtrated lixivium was very limpid, but emitted the peculiar smell of the phosphoric liquor. By evaporation it yielded a salt which did not deliquesce in the air, of an irregular shape; and which being put on burning coals, did not smell sensibly of arsenic; lost its water of crystallization; and became mealy and white without being dissipated by heat. On exposing the residuum to the air, it was found next day resolved into a liquor; whence it is probable that most of it was composed of crystallized alkali, having received from the decomposition of the vinegar as much fixed air as was necessary for its crystallization."

1522 Effect of the acetous acid on mercury.

This acid does not act upon mercury in its metallic state, but dissolves the mercurial calces, as red precipitate, turbith mineral, and the precipitate formed by adding fixed alkali to a solution of mercury in nitrous acid; with all which it forms white, shining, scaly crystals, like those of sedative salt.

1523 On silver.

Vinegar does not act upon silver in its metallic state, but readily dissolves the yellow calces precipitated from its solution in nitrous acid by microcosmic salt and volatile alkali. By the help of a boiling heat also it very copiously dissolves the precipitate obtained by means of a fixed alkali. The last mentioned solution yields shining, oblong, needle-shaped, crystals, which are changed to a calx by means of several acids, especially the muriatic. The silver is thrown down in its metalic form by zinc, iron, tin, copper, and quicksilver.

1524 On gold.

Though the acetous acid has no effect upon gold in its metallic state, yet a solution of this metal is decomposed by crude vinegar, which produces both a metallic precipitate and dark violet-coloured powder: Distilled vinegar throws down the gold in its metallic form. The precipitate by fixed alkali digested with acetous acid is of a purple colour. This, as well as fulminating gold, is dissolved by Westendorff's concentrated vinegar; the fulminating gold very easily. The solution is of a yellow colour; and with volatile alkali affords a yellow precipitate; with lixivium sanguinis, a blue one; both of which fulminate. The dry salt of gold dissolves in the acetous acid, and produces oblong yellow crystals.

1525 On inflammable substances.

This acid has no effect on fat oils, farther than that when distilled together, some mixture takes place, as the Abbé Rozier has observed. Neither does distilled vinegar act upon essential oils, though M. Westendorff's distilled vinegar dissolved about a sixth part of oil of rosemary, and about half its weight of camphor. The latter solution was inflammable, and let fall the camphor on the addition of water. The acid dissolves all the true gums, and some of those called gum-resins, after being long digested with them. By long boiling, Boerhaave observes, that it dissolves the bones, cartilages, flesh, and ligaments of animals.

1526 Concentration of the acetous acid.

The concentration of this acid may be effected by combining it with alkalies, earths, and metals. By combining it with copper, and then crystallizing and distilling the compound, we obtain the acid in the highest state of concentration in which it is usually met with. To produce this strong acid, we have only to distill verdegris, or rather its crystals in a retort. The operation must be begun by a very gentle fire, which brings over an aqueous liquor. This is to be set aside, in order to procure the more concentrated acid, which comes over with a stronger fire. On changing the receiver, and augmenting the heat, we obtain a very strong acid which comes over partly in drops, and partly in white vapours. It is called radical vinegar, or sometimes spirit of Venus, and has a very pungent smell, almost as suffocating as that of volatile sulphureous acid. As the last portions of it adhere pretty strongly to the metal, we are obliged to raise the heat to such a degree as to make the retort quite red in order perfectly to separate them. Hence some part of the metal is raised along with the acid, which, dissolving in the receiver, gives the liquor a greenish colour; but from this it may be easily freed by a second distillation, when it rises with a very gentle heat,

and

Acetous acid.

and becomes extremely white. Cryſtals of verdegris afford about one half their weight of radical vinegar; but verdegris itſelf much leſs, and of a more oily quality.

1527 Of its cryſtallization.

If this acid be heated in a wide-mouthed pan, and fire applied to it, it will burn entirely away like ſpirit of wine. This obſervation we owe to the count de Lauragais, who has likewiſe obſerved, that it is capable of cryſtallization. This, however, takes place only with the laſt portions which came over, and the cryſtals appear in the form of plates or needles. The marquis de Courtrivon, who has repeated and confirmed the experiment of the count de Lauragais, ſuppoſes this phenomenon to be owing to a ſulphur-like mixture of acetous acid and phlogiſton. Leonhardi ſuppoſes an analogy between theſe cryſtals and the white ſalt of copper expelled at the end of the operation by the count de Laſſone. This ſalt was at firſt very white, and fixed on the neck of the retort pretty thick; but unleſs quickly collected, was ſoon deſtroyed by the ſucceeding vapours. When expoſed to the air, it attracts moiſture, and runs into a greeniſh liquid. It is uncommonly light, and in ſuch ſmall quantity, that ſcarce five or ſix grains can be collected from a pound of verdegris. Its taſte is acid, auſtere, very unpleaſant and permanent. It readily and totally diſſolves in water, and partially in ſpirit of wine, leaving a yellow powder totally ſoluble in volatile alkali, and which burns with a green flame. From this ſalt, volatile alkali acquires a blue colour, and litmus a red one; and thus it diſcovers itſelf to be compoſed of acetous acid and copper.

1528 Difference between radical vinegar and common acetous acid.

Experience has ſhown that radical vinegar differs conſiderably in its properties from the common acid. It has a greater attraction for alkalies, forms with them more perfect combinations, and is leſs volatile. M. Berthollet obſerves, that when vinegar concentrated by froſt and radical vinegar, are reduced to equal denſities, by adding water to the heavier of the two, they differ very much both in ſmell and taſte. Laſſone found, that radical vinegar formed a cryſtallizable compound with volatile alkali; and Berthollet has obſerved the ſame with regard to fixed vegetable alkali. The cryſtals of the latter with radical vinegar were flat, tranſparent, and flexible, ſlowly deliqueſcent in the air. On comparing the ſalts formed by the two acids, he found, that the acetous ſalt rendered the ſyrup of violets green; but its colour remained unaltered with that made with radical vinegar. The latter alſo required a ſtronger fire to expel part of its acid; it was alſo whiter, and had a leſs acid taſte. On pouring radical vinegar on the acetous ſalt, the ſolution afforded, by evaporation and cryſtallization, a ſalt perfectly ſimilar to that procured directly from radical vinegar and fixed alkali. On diſtilling the mixture, the radical vinegar appeared to have expelled the common acetous acid, as the liquor which came over effervеſced with vegetable alkali, and formed with it a terra foliata tartari.

"It ſeems probable (ſays Mr Keir), that the radical vinegar contains a larger portion of the aerial principle than the common acetous acid; by which it undergoes a change ſimilar to that of marine acid, when brought into that ſtate in which it is ſaid to be dephlogiſticated. This air it may acquire from the metallic calx, which being deprived of its air is reduced to its metallic ſtate. Thoſe who believe in the phlogiſton of metals, may ſay that the acid is dephlogiſticated by imparting its phlogiſton to the metal, which is thereby metallized. It appears, however, to be very diſtinct from common acetous acid, and deſerves to have its properties and compounds farther inveſtigated."

1529 How to obtain it pure from terra foliata tartari.

Concentrated acetous acid, of a great degree of ſtrength may alſo be obtained by diſtilling terra foliata tartari with vitriolic acid; but Leonhardi obſerves, that the acid thus obtained is always more or leſs contaminated with the volatile acid of ſulphur. He obſerves alſo, that the method propoſed of ſeparating the ſulphureous acid by a ſecond diſtillation from ſalt of tartar is not effectual, becauſe the ſulphureous acid has leſs attraction for alkalies than the acetous. Weſtendorf recommends the neutral ſalt formed by acetous acid and mineral alkali, inſtead of the terra foliata tartari. Thus, in the firſt place, we readily obtain cryſtals free from the inflammable matter of the vinegar; and, in conſequence of this, though we diſtil it afterwards with concentrated oil of vitriol, no ſulphureous taint can be produced. Even ſuppoſing this to be the caſe (he ſays), it may be removed by a ſecond diſtillation from ſome mineral alkali. Mr Keir, however, obſerves, that "probably all the acids diſtilled from acetous ſalts by means of the vitriolic, partake of the property of that procured by diſtilling cryſtals of verdegris; and none of them can compare with that from which Mr Louitz obtained acetous ether without addition, as a pure concentrated and unaltered vinegar."

## XIV. *Acid of Benzoin.*

1530 M. Lichtenſtein's account of its properties.

The properties of this acid have been inveſtigated by M. Lichtenſtein, and are as follow. 1. Expoſed to the heat of a candle in a ſilver ſpoon, it melts as clear as water, without burning, though it is deſtroyed by contact of flame. 2. When thrown upon coals, it evaporates, without reſiduum, in a thick white ſmoke. 3. It is not volatile without a conſiderable degree of heat. 4. By very ſlow cooling its aqueous ſolution yields large cryſtals, long, thin, and of a feathery ſhape. 5. It is ſoluble in the concentrated acids of nitre and vitriol, but ſeparates from them, without decompoſition, on the addition of water. 6. By the other acids it cannot be diſſolved without heat, and ſeparates from them alſo without any change, merely by cooling. 7. It is copiouſly diſſolved by ſpirit of wine, and precipitated from it on the addition of water. 8. With alkalies it forms neutral ſalts, very ſoluble in water, and of a ſharp ſaline taſte. With vegetable alkali it forms cryſtals of a pointed feathery form: with mineral alkali it yields larger cryſtals, which fall into powder on being expoſed to the air; and with volatile alkali it is difficultly cryſtallizable into ſmall, feathery, and deliqueſcent cryſtals. It is ſeparable from alkalies by the mineral acids. 9. With calcareous earth it forms white, ſhining, and pointed cryſtals, not eaſily ſoluble, and which have a ſweetiſh taſte without any pungency. 10. With magneſia ſmall

Acetous acid.

small feathery cryſtals are formed, of a ſharp ſaline taſte, and eaſily ſoluble in water. 11. An aſtringent ſalt is formed with earth of alum.

All theſe earthy ſalts are eaſily decompoſed by the mineral acids as well as by alkalies. The acid of benzoin itſelf reddens litmus, but has little effect upon ſyrup of violets.

1531 Effects of nitrous acid upon it.

Meſſrs. Hermbſtadt and Lichtenſtein have both tried the effects of nitrous acid upon that of benzoin. In this operation, however, a great obſtacle aroſe from the volatility of the acid of benzoin, which prevented it from bearing any conſiderable heat without paſſing over into the receiver. By repeated diſtillations, however, the acid of benzoin, diminiſhed in its volatility, aſſumed a darker colour, and acquired a bitteriſh taſte. A coal was alſo left at the bottom; and, at the end of the third operation, when the nitrous acid had been all drawn off, M. Hermbſtadt obſerved that ſome brown drops came over which had the appearance of a dark-coloured tranſparent oil, ſoluble in diſtilled water, emitting acrid fumes, and having a very cauſtic taſte. On diſtilling this acid liquor a ſecond time, a yellow ſaline maſs was obtained, which, when diſſolved in diſtilled water, formed a fluid acid, which precipitated a ſolution of ſugar of lead and lime-water. On examining the charred reſiduum left in the retort, he obſerved, that, after calcination, ſome of the earth had been vitrified, while another was of a ſoft conſiſtence, and had acquired a cauſtic taſte. From a mixture of the abovementioned dark-brown acid and ſpirit of wine, he obtained an ether, which differed from the nitrous in being much leſs volatile, and ſmelling like bitter almonds.

From this reſiduum Mr Lichtenſtein obtained a reſinous ſubſtance, to which he aſcribes the volatility of the acid of benzoin, as well as the ſmell of bitter almonds already mentioned.

Scheele failed in his attempt to obtain ether from flowers of benzoin and ſpirit of wine; but, by adding a little ſpirit of ſalt, he obtained a kind of ether which fell to the bottom. On diſſolving this in alkalized ſpirit of wine, and drawing off the latter by diſtillation, he obtained from it a quantity of flowers of benzoin.

1532 Acid of benzoin procurable from Peruvian balſam and urine.

From Peruvian balſam alſo Lehman obtained a quantity of the acid of benzoin. It may alſo be procured from urine, either by precipitation, from the ſaponaceous extract (A), or by repeatedly diſtilling from it ſpirit of nitre, as in the preparation of acid of ſugar. In the urine it is found combined with volatile alkali, by which it becomes ſoluble in ſpirit of wine.

## XV. *Sebaceous Acid.*

This is ſaid to have been firſt diſcovered by Mr Gruitzmacker, who publiſhed an account of it in 1748. It was afterwards more accurately treated of by Mr Rhades in 1753. Its properties were inveſtigated by Meſſrs Segner and Knappe in 1754; and afterwards more fully by Dr Crell, of whoſe diſcoveries an account is given in the Philoſophical Tranſ-



Sebaceous acid.

actions for 1780 and 1782. It is found not only in the fat of all animals, but in ſpermaceti, the butter of cocoa, and probably in other vegetable oils. In ſeveral reſpects it ſeems analogous to the marine acid;

1533 Sebaceous acid procurable from various ſubſtances.

but in others it is remarkably different, particularly in precipitating a ſolution of corroſive ſublimate. It is probable, however, that is principles are the ſame with thoſe contained in all other vegetable and animal acids; and this opinion is ſupported by what happens on treating tallow in the uſual manner for obtaining acid of ſugar; for thus, not the ſebaceous, but the ſaccharine acid is found to be produced.

1534 Has a remarkable power of attraction.

It has a very great ſtrength of attraction, and by means of heat decompounds even the vitriolic ſalts themſelves; but in the moiſt way is expelled by the three mineral acids, though it expels all the vegetable ones, as well as thoſe of fluor and arſenic.

1535 Remarkable effect on tin.

Its moſt remarkable property is its effect on tin. The filings of this metal, eſpecially with the aſſiſtance of heat, are corroded by it into a yellow powder, and at the ſame time give out a very fetid ſmell. The ſolution, though filtered, ſtill continues turbid, and depoſits more yellow powder, acquiring at the ſame time a fine roſe-red colour. By adding water to this yellow powder, a white deliqueſcent ſalt may be obtained, and a ſimilar one obtained by diſſolving a yellow powder precipitated by this acid from ſolution of tin in aqua-regia.

1536 Its effects on other ſubſtances.

It corrodes lead rather than diſſolves it; but diſſolves a conſiderable quantity of minium, and changes the reſt to a white powder. This ſolution is ſweetiſh, and is not precipitated by common ſalt. The metal is precipitated by ſebaceous acid from the nitrous, in white needle-like cryſtals, eaſily ſoluble in water. A like precipitation takes place in ſolution of ſugar of lead; but the precipitate is ſtill ſoluble in ſtrong vinegar, provided it be not adulterated with oil of vitriol. In its elective attractions it agrees with the acids of apples and of fluor, preferring magneſia to fixed alkali.

## XVI. *Acid of galls.*

Though it has for a long time been known that the infuſion of galls has the property of reddening vegetable juices, diſſolving iron, and decompoſing liver of ſulphur, theſe effects were generally aſcribed to its aſtringency. Of late, however, it has been found, that beſides this aſtringent principle a true acid exiſts in galls; and to this, rather than to the aſtringent principle, are we to aſcribe the properties of galls in ſtriking a black with ſolution of vitriol, &c.

1537 Method of ſeparating the acid.

To ſeparate the acid from the other matters contained in the galls, we muſt add fixed alkali to a decoction of them; by which means the aſtringent matter will be thrown down, and the acid remain in the liquor joined to the alkali, the precipitate, waſhed with clean water, dried, and rediſſolved, blackened a ſolution of vitriol but faintly, and no more than what may be ſuppoſed to proceed from ſome remaining acid, which could not be abſtracted. This is proved by diſtilling

(A) By this is meant urine evaporated to a thick conſiſtence, and deprived of moſt of its ſalts by ſolution in ſpirit of wine.

Acid of galls.

1538 An acid obtained from galls by distillation.

ftilling the aftringent matter in queftion, when an acid liquor comes over, which has the property of blackening folution of vitriol. Scheele has obferved, that when galls in fubftance are expofed to diftillation, an acid liquor rifes of an agreeable fmell, without oil, and afterwards a kind of volatile falt, which is the true acid of the galls. Hence he infers, that this falt is contained ready formed in the galls themfelves; but fo much involved in fome gummy or other matter, that it cannot be eafily obtained feparately.

The acid of galls is capable of being feparated by cryftallization. In an infufion made with cold water, Scheele obferved a fediment which appeared to have a cryftalline form, and which was acid to the tafte, and had the property of blackening folution of vitriol. By expofing the infufion for a long time to the air, and removing from time to time the mouldy fkin which grew upon it, a large quantity of fediment was formed. On rediffolving this in warm water, filtering and evaporating it very flowly, an acid falt was obtained

1539 Properties of this acid. in fmall cryftals like fand, which had the following properties: 1. It tafted acid, effervefced with chalk, and reddened litmus. 2. Three parts of boiling water diffolved two of the falt; but 24 parts of cold water were required to diffolve one. 3. It is likewife foluble in fpirit of wine; four parts of which are required to diffolve one of the falt when cold, but only an equal quantity when affifted by a boiling heat. 4. The falt is deftructible by an open fire, melts and burns with a pleafant fmell, leaving behind a hard infoluble coal, which does not eafily burn to afhes. 5. By diftillation an acid water is firft obtained without any oil: then a fublimate, which remains fluid while the neck of the retort is hot, and then cryftallizes. This fublimate has the tafte and fmell of flowers of benzoin; is foluble in water and in fpirit of wine; reddens litmus; and precipitates metallic folutions of the following colours, viz. gold of a dark brown; filver of a grey colour; copper of a brown; iron of a black; lead of a white colour; mercury of an orange; bifmuth, lemon-coloured. The acid of molybdæna became yellow coloured, but no precipitate enfued. Solutions of various kinds of earths were not altered; but lime-water afforded a copious grey-coloured precipitate. 6. By treating this acid with that of nitre, in the manner directed for producing acid of fugar, it was changed into the latter.

## XVII. *Identity of the Vegetable Acids.*

1540 Mr Keir's objections to the opinions on this fubject.

On the proofs of the identity of the vegetable acids with one another, Mr Keir makes the following remarks: "The experiments and obfervations which have been made, prove evidently a ftrong analogy between the acetous acid, fpirit of wine, tartar, and acid of fugar; and they feem to fhow the exiftence of a common principle or bafis in all of them, modified either by the addition of another principle not common to all of them, or by different proportions of the fame principle. None of the opinions on this fubject, however, are quite fatisfactory. The production of the acetous acid by treating fpirit of wine with other acids, does not prove that the acetous acid was contained in the fpirit of wine, but only in concurrence with them, that they contain fome common principle. There is no fact adduced to fupport Morveau's opinion, that fixed air is abforbed during the acetous fermentation; or that the prefence of this fixed air is neceffary. The decompofition of all vegetable acids by heat, and the production therefrom of fixed and inflammable gafes, fhow that thefe acids contain fome of the fame principles as thefe elaftic fluids, but do not prove that the gafes exifted in the fluids. We have good reafon to believe that acetous acid does not contain any fixed air already formed; for it yields none when vitriolic acid is added to it, or to foliated earth; neverthelefs, my opinion that vegetable and animal acids are, by heat, in a great meafure convertible into fixed air, feems to be fufficiently proved by experiments. Thus Hales has fhown the great quantities of

Indentity of the vegetable acids.

1542 Quantities of the different fubftance obtained from foliated earth.

this gas which tartar yields on diftillation. Berthollet has obtained the fixed and inflammable gafes from foliated earth; and Dr Higgins has verified this experiment, and deduced the quantities. From 7680 grains of foliated earth, the Doctor obtained.

| | | |
|---|---|---|
| Cauftic alkali | - | 3862.994 grains. |
| Fixed air | - | 1473.564 |
| Inflammable air | - | 1047.6018 |
| Oily matter retained in the refiduum | - | 78 |
| Oil | - | 182 |
| Water condenfed | - | 340 |
| Deficiency attributed chiefly to water | - | 726.9402" |

As fixed and inflammable gafes may be obtained from every vegetable fubftance by fire, nothing can be inferred from thefe experiments to explain particularly the nature of the acetous acid, excepting that it contains fome of the inflammable matter common to the vegetable kingdom, and efpecially of the matter common to vegetable acids; all which alfo, when analyfed, furnifh large quantities of thefe two gafes.

"Although we are far (adds our author) from the knowledge requifite to give a complete theory of the acetous fermentation, yet it may be ufeful to explain the ideas that appear moft probable. In all the inftances that we know of the formation of acids, whether effected by combuftion, as the acids of fulphur and phofphorus, or by repeated abftractions of nitrous acid, as in the procefs for making acid of fugar, a very fen- 1543

1543 Air abforbed in the formation of all acids.

fible quantity of pure air is abforbed. In the cafe of combuftion we know, from the weight acquired, that there is a great abforption of air; and in the latter cafe, of acids being produced by application of nitrous acid, as this acid confifts of nitrous and pure air, and as in thefe operations a quantity of the nitrous gas is expelled, there feems but little doubt that there alfo the pure air of the nitrous acid is united with the fubftance employed in the formation of the new acid. Hence, from all that we know, the abforption of air takes place in all acidifying proceffes. But it alfo actually takes place in the acetous fermentation, as has been obferved, particularly by the Abbe Rozier; and it is generally known, that air is neceffary to the formation of vinegar. The next queftion is, What is the bafis? And from the experiments already related, of forming the acetous acid by means of fpirit of wine, it feems probable, either that this fpirit is the bafis of the acetous acid, or that it contains this bafis: and from the convertibility of the acids of tartar and of

fugar

Identity of the vegetable acids. ſugar into the acetous acid by the proceſſes above deſcribed, it ſeems probable that theſe alſo contain the ſame common baſis; which, being united with a determined quantity of pure air, forms acid of tartar; with a larger quantity, acid of ſugar; and with a ſtill larger, the acetous acid.

1544 Inflammable ſpirit produced from radical vinegar. "An inflammable ſpirit is ſaid to appear at the end of the diſtillation of radical vinegar from verdigris. Now, if the ardent ſpirit were contained in the verdigris, as it is more volatile than the acid, it ought to come over firſt; but as it appears only towards the end of the diſtillation, it ſeems to be formed during the operation; and I imagine, that the metal, when almoſt deprived of its acid, attracts ſome of the air of the remaining acid; and the part or baſis of the acid thus deprived of its air becomes then an inflammable ſpirit, and in ſome caſes an oil appears. But as the quantity of acid thus decompoſed is very ſmall, and little air of conſequence remains united with the metallic part of the verdigris, the copper appears rather in a metallic than calciform ſtate after the operation. But zinc, during its ſolution in concentrated vinegar, decompoſes the acid as it does the vitriolic and other

1545 Sulphureous inflammable vapours produced from it. ſtrong acids, and accordingly inflammable vapours are produced; and what is remarkable, theſe vapours have a ſulphureous ſmell. Iron always, during its ſolution in concentrated vinegar, produces an expulſion of inflammable vapours; which, however, do not explode like inflammable gas.

1546 Of the conſtituent parts of the acetous acid. "We muſt not imagine that we are yet able to explain completely what paſſes in the acetous fermentation, or that the acetous acid is a compound of mere ſpirit and pure air. Beſides this combination of ſpirit and air, it is obſerved, that a precipitation always takes place before the fermentation is completed, of ſome mucilaginous matter, which diſpoſes the vinegar to putrefy, and from which it therefore ought to be carefully ſeparated. Stahl affirms, that without a depoſition of ſuch ſediment, vinegar cannot be made from ſugar, wine, or other juice. Beſides the matter that is depoſited, probably as much remains in the liquor as can be diſſolved therein; for, by diſtillation, much of a ſimilar extractive matter is left in the retort. What the nature of this matter is, and how it is formed, has not yet been examined. Though diſtillation frees the acid from much of this extractive ſubſtance, yet we have no reaſon to believe that we have ever obtained it entirely free from inflammable matter; as it retains it even when combined with alkalies and with metals. When ſugar of lead and other acetous ſalts are diſtilled with a ſtrong heat, the ſubſtances remaining in the retort have been obſerved to poſſeſs the properties of a pyrophorus; and this will happen whatever pains have been taken to purify the vinegar employed. See the article PYROPHORUS. This fact ſhows the exiſtence of an inflammable matter in this acid; and which may perhaps be eſſential in its com-

1547 It is formed in various chemical proceſſes. poſition, and neceſſary to its properties. Although fermentation is the uſual mode of obtaining acetous acid, yet it appears from the inſtances obſerved by latter chemiſts, that it is not eſſential to its formation, but that it is alſo formed in various chemical proceſſes; and the acid obtained by diſtillation from woods, wax, &c. are very analogous to vinegar. It appears alſo on treating the acid of ſugar with nitrous acid, as has been obſerved both by Weſtrumb and Scheele. The latter further acquaints us, that he obtained it in analyſing a tallow like oil, which remained undiſſolved upon digeſting ſtarch in nitrous acid. As acid of ſugar alſo may be obtained from a variety of animal ſubſtances, and as this acid is convertible into the acetous we have one reaſon more added to many others, to prove that the matters of vegetable and animal ſubſtances are not capable of any chemical diſtinction." Addition to Sect. I. § 20.

## XVIII. ADDITION to Sect. I. § 20. *concerning the volatility of a Mixture of MARINE and NITROUS ACIDS.*

THIS is much leſs ſenſible when the acids are weak than when they are concentrated. On mixing the two when moderately ſmoking, and which had remained for a long time ſeparate without occaſioning any diſturbance, a vaſtly ſmoking aqua-regia has been produced, which would either drive out the ſtopple, or burſt the bottle in warm weather. On diſtilling a pretty ſtrong nitrous acid from ſal ammoniac, M. Beaumé obſerved, that the vapours which came over were ſo exceedingly elaſtic, that notwithſtanding every precaution which could be taken in ſuch a caſe, the diſtillation could not be continued. By letting this eſcape, however, Mr Cornette obſerved, that the diſtillation of theſe two ſubſtances may be carried on to the end without any inconvenience, and the aqua-regia will then be no longer troubleſome. 1548 How to deprive aqua-regia of its volatility.

## XIX. *TEST for ACIDS and ALKALIES.*

THE general method recommended for diſcovering a ſmall quantity of acid or alkali in any liquid, is by trying it with any vegetable blue, ſuch as ſyrup of violets; when, if the acid prevails in the liquor, the ſyrup will acquire a red colour, more or leſs deep according to the quantity of acid; or if the alkali prevail, it will change the ſyrup green in like proportion. 1549 Since the late improvements in chemiſtry, however, the ſyrup has been found deficient in accuracy, and the infuſion of turneſole, or of an artificial preparation called litmus, have been ſubſtituted inſtead of it. Inaccuracy of the common teſts. The infuſion of litmus is blue, and, like ſyrup of violets, becomes red with acids. It is ſo ſenſible that it will diſcover one grain of oil of vitriol though mixed with 100,000 of water. Unfortunately, however, this infuſion does not change its colour on mixture with alkalies; it is therefore neceſſary to mix it with juſt as much vinegar as will turn the infuſion red, which will then be reſtored to its blue colour by being mixed with any alkaline liquor. The blue infuſion of litmus is alſo a teſt of the preſence of fixed air in water, with which it turns red, as it does with other acids.

The great ſenſibility of this teſt would leave very little reaſon to ſearch for any other, were it always an exact teſt of the point of ſaturation of acids and alkalies; but, from the following fact, this appears to Mr Watt to be dubious. A mixture of phlogiſticated nitrous acid with an alkali will appear to be acid by the teſt of litmus, when other teſts, ſuch as the infuſion of the petals of the ſcarlet roſe, of the blue iris, of violets, and of other flowers, will ſhow the ſame liquor to be alkaline, by turning green ſo evidently as to leave no room to doubt.

When Mr Watt made this diſcovery, the ſcarlet roſes, Test for acids and alkalies.

ses, and several other flowers, whose petals change their colour by acids and alkalies, were in flower. Having stained paper with their juices, he found that it was not affected by the phlogisticated nitrous acid, excepting in so far as it acted the part of a neutralizing acid; but he found also, that, paper stained in this manner was much less easily effected than litmus was; and that, in a short time, it lost much of the sensibility which it possessed at first; and having occasion in winter to repeat some experiments in which the phlogisticated nitrous acid was concerned, he found his stained paper almost useless. Searching, therefore, for some other vegetables which might serve for a test at all seasons of the year, he found the red cabbage to answer his purpose better than any other; having both more sensibility with regard to acids than litmus, being naturally blue, and turning green with alkalies, and red with acids; to all which is joined the advantage of its being no farther affected by the phlogisticated acid of nitre than as it acts as a real acid.

1550 Red cabbage answers the purpose best.

1551 How to prepare it for use.

To prepare this test, Mr Watt recommends to take the freshest leaves of the cabbage; to cut out the large stems, and mince the thin parts of the leaves very small; then to digest them in water at about the heat of 120 degrees for a few hours, when they will yield blue liquor; which, if used immediately as a test, will be found to possess great sensibility: but as in this state it is very apt to turn putrid, some of the following methods must be used for preserving it.

1. After having minced the leaves, spread them on paper, and dry them in a gentle heat; when perfectly dry, put them up in glass bottles well corked; and, when you want to use them, acidulate some water with vitriolic acid, and digest or infuse the dry leaves in it, until they give out their colour; then strain the liquor through a cloth, and add to it a quantity of fine whiting or chalk, stirring it frequently, until it becomes of a true blue colour, neither inclining to green nor purple; when you perceive that it has acquired this colour, filter it immediately; otherwise it will become greenish by standing longer on the whiting. This liquor will deposit a small quantity of gypsum, and, by the addition of a little spirit of wine, will keep good for some days; but will then become somewhat putrid and reddish. If too much spirit is added, it destroys the colour. If the liquor is wanted to keep longer, it may be neutralized by a fixed alkali instead of chalk.

2. As thus the liquor cannot be long preserved without requiring to be neutralized afresh just before it is used; and as the putrid fermentation which it undergoes, and perhaps the alkalies or spirit of wine mixed with it, seem to lessen its sensibility; in order to preserve its virtues while kept in a liquid state, some fresh leaves of the cabbage, minced as above directed, may be infused in a mixture of vitriolic acid and water, of about the degree of acidity of vinegar; and it may be neutralized, as it is wanted, either by means of chalk, or of the fixed or volatile alkali. It must be observed, however, that if the liquor has an excess of alkali, it will soon lose its colour, and become yellow; from which state it cannot be restored; care should therefore be taken to bring it very exactly to a blue, and not to let it verge towards a green.

3. In this manner, Mr Watt prepared a red infusion of violets; which, on being neutralized, formed a very sensible test, though he did not know how long these properties would be preserved; but he is of opinion that the coloured infusions of other vegetables may be preserved in the same manner by the antiseptic power of the vitriolic acid, in such a manner as to lose little of their original sensibility. Paper fresh stained with these tests, in their neutral state, has sufficient sensibility for many experiments; but the alum and glue which enter into the preparation of writing paper, seem, in some degree, to fix the colour; and paper which is not sized becomes somewhat transparent when wetted; which renders small changes of colour imperceptible. Where accuracy is required, therefore, the test should be used in a liquid taste.

1552 Various other tests.

4. Our author has found that the infusion of red cabbage, as well as of various flowers in water, acidulated by means of vitriolic acid, are apt to turn mouldy in the summer season, and likewise that the moulding is prevented by an addition of spirit of wine. He has not been able to ascertain the quantity of spirit necessary for this purpose, but adds it by little and little at a time until the process of moulding is stopped.—Very sensible tests are afforded by the petals of the scarlet rose, and of the pink coloured lychnis treated in the abovementioned manner.

## XX. *Volatile Alkali.*

Volatile alkali.

1553 Volatile alkali prepared from nitrous acid and tin.

Mr Higgins claims the first discovery of the constituent parts of volatile alkali, or at least of an experiment leading to it. "About the latter end of March 1785 (says he), I found that nitrous acid poured on tin filings, and immediately mixed with fixed vegetable alkali, generated volatile alkali in great abundance: so singular a fact did not fail of deeply impressing my mind, though at the time I could not account for it. About a fortnight after, I mentioned the circumstance to Dr Brocklesby. He told me he was going to meet some philosophical gentlemen at Sir Joseph Banks's, and desired I would generate some alkali to exhibit before them: accordingly I did; and had the pleasure of accompanying him thither. The December following I mentioned the fact to Dr Caulet, and likewise the copious generation of volatile alkali from Prussian blue, vegetable alkali, and water; on which we agreed to make a set of experiments upon the subject. At present I shall only give an account of the following, which drew our particular attention. Into a glass cylinder, made for the purpose, we charged three parts of alkaline air, and to this added one part of dephlogisticated air; we passed the electrical spark repeatedly in it, without apparently effecting the smallest change. When it had received about 100 strong shocks, a small quantity of moisture appeared on the sides of the glass, and the brass conductors seemed to be corroded; when we had passed 60 more shocks in it, the quantity of moisture seemed to increase, and acquire a greenish colour, though at this time the column of air suffered no diminution. On examining the air, it burned with a languid greenish flame, from which we inferred that the dephlogisticated air was totally condensed: it still retained an alkaline smell; and the alkaline part was not readily absorbed by water.

1555 Effects of the electric spark on it.

"From

Pruffian blue.

"From Mr Cavendifh's famous difcovery of the conftituent parts of water we could readily account for the lofs of the dephlogifticated air in this experiment; but the quantity of water was more than we could expect from this: therefore water muft have been precipitated from the decompofed alkali; for volatile alkali, from its great attraction to water, muft keep fome in folution even in its aeriform ftate. From the above circumftances it might be expected, that a contraction of the column of air fhould take place; but it muft be confidered, that the union took place gradually in proportion as the alkali was decompofed; and that, in this cafe, the expanfion muft equal the condenfation. During the fpring of 1786 I had often an opportunity of mentioning different facts to Dr Auftin relating to volatile alkali, who at that time was too much engaged to pay attention to the fubject. In the end of Auguft 1787, he gave me an account of a fet of experiments which he had made, and which actually proved, that volatile alkali confifts of light inflammable and phlogifticated airs; not knowing at that time what Meffrs Houfman and Berthollet had done. Without depreciating the merit of thefe two gentlemen, Dr Auftin has an equal claim to the difcovery, laying afide priority; as his experiments are as decifive as theirs. Dr Prieftley made the firft ftep towards our knowledge of volatile alkali."

1556 True compofition of volatile alkali.

## XXI. *Prussian Blue.*

1557 Woulfe's teft for mineral waters.

The acid of this fubftance, as far as it contains an acid, is fuppofed to be that of phofphorus. Mr Woulfe propofed a teft of this kind for difcovering iron in mineral waters, which, he obferved, would not be affected by acids; but the lixivium defcribed by him had the bad property of letting fall the Pruffian blue it contains in a few weeks. The precipitate of copper, however, treated again with alkali, retained this property upwards of nine months. The volatile alkali, he obferves, is diffolved by the Pruffian acid; and the cryftals depofited are rendered blue by the colouring matter, though the colour at firft is loft by the union of the alkali with the fubftance already made. The metals were precipitated by this teft of the following colours: Gold of a brownifh yellow, the precipitate afterwards becoming of a full yellow; platina of a deep blue, but when quite pure, of a yellow colour, turning flightly green. Silver in the nitrous acid was precipitated of a whitifh colour; copper from all the different acids was precipitated of a deep brown colour, the liquid remaining greenifh; green vitriol let fall a deep blue powder, leaving a colourlefs lixivium; fugar of lead and muriated tin gave a white powder; nitrated mercury a white or yellowifh precipitate; the Illfeld manganefe a brownifh, but that from Devonfhire a blue, which firft became afh-coloured and then reddifh. Nitrated bifmuth afforded a white precipitate, and the lixivium was flightly green: muriated antimony yielded a white precipitate, with a yellowifh lixivium: vitriolated zinc a whitifh: cobalt in aqua-regia a reddifh white powder: the precipitate of arfenic and the different earths was commonly white.

1558 Effect of it on various metallic folutions.

## XXIII. *New Chemical Nomenclatures.*

New chemical nomenclatures.

### 1. *Of that propofed in 1787 by Meffrs Morveau, Berthollet, Fourcroy, and Lavoifier.*

When this nomenclature was firft publifhed, M. Lavoifier informs us, that fome blame was thrown upon the authors for changing the language, which had received the fanction of their mafters, and been adopted by them. In anfwer to this, however, he urges, that Meffrs Bergman and Macquer had expreffed a wifh for fome reformation in the chemical language. Mr Bergman had even written to M. Morveau on the fubject in the following terms. "Show no favour to any improper denomination: Thofe who are already poffeffed of knowledge, cannot be deprived of it by new terms; thofe who have their knowledge to acquire, will be enabled by your improvement on the language of the fcience to acquire it fooner."

1559 Bergman's letter to Morveau on this fubject.

The following is M. Lavoifiers explanation of the principles on which his new language is compofed. "Acids confift of two fubftances, belonging to that order which comprehends fuch as appear to us to be fimple fubftances. The one of thefe is the principle of acidity, and common to all acids; from it therefore fhould the name of the clafs and genus be borrowed: The other, which is peculiar to each acid, and diftinguifhes them from one another, fhould fupply the fpecific name. But in moft of the acids, the two conftituent principles, the acidifying and the acidifyed, may exift in different proportion, forming different degrees of equilibrium or faturation; this is obferved of the *fulphuric* and *fulphureous* acid. Thefe two ftates of the fame acid we have expreffed by varying the termination of the fpecific name.

1560 Lavoifier's explanation of the new nomenclature.

"Metallic fubftances, after being expofed to the compound action of air and fire, lofe their metallic luftre, gain an increafe of weight, and affume an earthy appearance. In this ftate they are, like acids, compound bodies, confifting of one principle common to them all, and another peculiar to each of them. We have therefore in like manner claffed them under a generic name, derived from the principle which is common to them all. The name which we have adopted is *Oxide:* The peculiar names of the metals from which they are formed, ferve to diftinguifh thefe compounds from one another.

"Combftuible fubftances, which, in acids and metallic oxides, exift as fpecific and peculiar principles, are capable of becoming, in their turn, the common principle of a great number of fubftances. Combinations of fulphur, were long the only compounds of this fort known: but of late the experiments of Meffrs Vandermonde, Monge, and Berthollet, have fhown that coal combines with iron and perhaps with various other metals; and that the refult of its combination with iron are, according to the proportions, fteel, plumbago, *&c.* It is alfo known from the experiments of M. Pelletier, that phofphorus combines with many metallic fubftances. We have therefore arranged thefe different combinations together under generic names, formed from the name of the common fubftance, with a termination indicating this analogy; and have diftinguifhed them from each other by fpecific names derived from the names of the peculiar fubftances.

"It

New chemical nomenclatures.

"It was found somewhat more difficult to form a nomenclature for the compounds of those three simple substances; because they are so very numerous, and still more, because it is impossible to express the nature of their constituent principles, without using more compound names. In bodies belonging to this class, such as neutral salts for instance, we had to consider, 1. the acidifying principle common to them all; 2. the acidifiable principle which peculiarizes the acid; 3. the saline, earthy, or metallic base, which determines the particular species of the salt. We have derived the name of each class of salts from that of the acidifiable principle, common to all the individuals of the class; and have then distinguished each species by the name of the *saline*, *earthy*, or *metallic* base peculiar to it.

"As salt, consisting of any three principles, may, without losing any of these principles, pass through different states by the variation of their proportions; our nomenclature would have been defective without expressions for these different states. We have expressed them chiefly by a change of termination, making all names of salts in the same state to end with the same termination."

2. *Nomenclature by M. Wiegleb.*

1562 Mr Wiegleb's nomenclature.

In Wiegleb's General System of Chemistry translated by Hopson, we have another nomenclature formed on different principles. In this he gives to fixed vegetable alkali the name of *Spodium*, from the Greek word σποδος *(ashes)*. The mineral alkali he calls *natrum*, the name by which it was anciently distinguished; and the volatile alkali *ammonium*, from sal ammoniac which contains it in great quantity. The compound salts may be distinguished into double, triple, and quadruple; though, in the scheme given in the work, the first division is omitted, as tending only to create confusion. The irregular salts, consisting of those which are triple and quadruple, are admitted. Such as are imperfect by reason of an excess of acid, he says, are best denominated by converting the adjective, expressive of the base, into a participle; a practice which, on many occasions, though countenanced by the authority of a late eminent writer, seems aukward and stiff. The excess of acid is denominated by the word *hyperoxys*, and a defect of it by *hypoxys*. Hence his denominations are formed in the following manner.

Salts with excess of acid. Cream of tartar, or *tartarus spodatus*, or *tartaroxys spodicus*. Acid vitriolated tartar, or vitriolum spodatum, *vitrioloxys spodicus*.

The salts which are imperfect from a defect of acid have their denominations by mentioning the base before the acid, and expressing the former substantively, the latter adjectively. Thus,

New chemical nomenclatures.

| | |
|---|---|
| Salt of tartar, aerated vegetable alkali, spodium aerocraticum, | Oxyspodium, aerocraticum. |
| Aerated volatile alkali, ammoniacum aerocraticum, | Oxyammonium aerocraticum. |
| Chalk, or calx aerocratica, | Oxycalcitis aerocraticus. |
| Borax, or natrum boracicum. | Oxynatrum boracicum. |

With respect to other terms, Mr Wiegleb expresses the acid with which any base is combined, by the termination *cratia*, from the Greek κρατος *(robur)*, added to it; excepting only those with the nitrous and muriatic acids: and these (for what reason does not appear) he calls *Aponitra* and *Epimuriæ*. His genera of salts are as follow.

1. Vitriols *(Sulphurocratia)*. 2. Nitres *(Aponitra)*. 3. Murias *(Epimuriæ)*. 4. Boraxes. 5. Fluoricrates. 6. Arsenicrates. 7. Barylithicrates, (those with acid of tungsten). 8. Molybdænocrates. 9. Photocrates, (with acid of phosphorus). 10. Electrocrates. 11. Oxycrates, (with the acetous acid); or *epoxycrates*, with the aerated acid). 12. Tartars; or, with the acid changed by fire, *pyro-tartars*. 13. Oxalidicrates. 14. Cecidocrates (with the acid of galls). 15. Citriocrates. 16. Melicrates (with the acid of apples). 17. Benzicrates. 18. Xylocrates. 19. Gummicrates. 20. Camphoricrates. 21. Aerocrates. 22. Galacticrates. 2[illegible]. Gala-melicrates (with acid of sugar of milk). 24. Myrmecicrates. 25. Cyanocrates (with the colouring matter of Prussian blue). 26. Steatocrates. 27. Bombycicrates. 28. Zoolithocrates, (with acid of calculus).

On the subject of nomenclatures it is obvious to remark, that whatever may be the defects of the old one, we are ready to be involved in much greater difficulties by the introduction of a new one. Or supposing a new language to be adopted, where would be the security for its permanence? That which appears most specious at one period, may still be superseded by the refinements of another; and colourable pretensions would never be wanting to successive innovators. Hence a continual fluctuation, and an endless vocabulary. As the nomenclature first abovementioned, however, has attracted no small degree of attention, we shall here subjoin a scheme of it, as well for the satisfaction of our readers in general, as for the gratification of those in particular who may have imbibed the doctrines of its authors.

[Follows *The Whole-sheet Table.*]

# TABLE, showing the Manner in which Natural Bodies, considered in a Chemical View, may be divided into Classes; with their several Subdivisions; their Properties defined; and the Manner in which they are obtained, pointed out.

*NATURAL BODIES, considered as the Objects of Chemistry, may be divided into the following Classes,* viz. 1. Salts. 2. Earths. 3. Metals. 4. Inflammables. 5. Waters. 6. Airs.

## I. SALTS.

These are soluble in water, sapid, and not inflammable. They are either Acids or Alkalies.

I. *Acids* are distinguished by turning syrup of violets red, or forming with alkalies neutral salts; and are supposed to consist of dephlogisticated air condensed, as their acidifying principle. The different acids yet known are,

1. *Vitriolic, fixed.* The most ponderous of all fluids next to mercury, the most fixed in the fire, and the most powerful as a solvent of all the acids. Obtained chiefly from sulphur by inflammation.
2. *Vitriolic, volatile.* Obtained also from sulphur by inflammation; air being admitted during the process. It acts less powerfully as a solvent than when in its fixed state.
3. *Nitrous* or *Aquafortis:* a volatile fluid, generally met with of a reddish colour, and emitting noxious fumes, when in its concentrated state; though this is found not to be essential to it, but owing to a mixture of phlogiston. In its pure state it is almost as colourless as water, and smokes very little. It is next in strength to the vitriolic acid, and obtained chiefly from nitre. It consists of dephlogisticated and phlogisticated air condensed, and may be obtained by taking the electric spark for a long time in a mixture of these. By uniting with some metals it appears to be converted into volatile alkali.
4. *Muriatic,* or *spirit of sea-salt.* A volatile fluid, generally of a fine yellow colour; though this also is owing to the admixture of foreign substances, generally of iron. Inferior in power to the former, and obtained from sea-salt. Naturally this acid seems to be in an aerial state, but easily contracts an union with water. On mixture with manganese, it is wholly converted into a yellow, and almost incondensible vapour, called *dephlogisticated spirit of salt;* but which, on mixture with inflammable air, recomposes the marine acid.
5. *Fluor acid.* Obtained from a species of spar: has little acid power, but is remarkable for its property of corroding glass.
6. *Acid of borax,* or *sedative salt.* Obtained from borax in the form of scaly crystals; found also naturally in some waters in Italy, and in certain minerals in other countries.
7. *Acetous acid.* Obtained by allowing any fermentable liquor to proceed in the fermentation till past the vinous state. It is much less corrosive, and less powerful as a solvent, than the vitriolic, nitrous, or marine acids.
8. *Acid of tartar.* Procured from the hard substance called *tartar,* deposited on the sides of wine vessels.
9. *Acid of sugar.* Found naturally in the juice of sorrel, and procured artificially by means of nitrous acid from sugar and a great variety of other substances. Assumes a dry form.
10. *Acid of phosphorus.* Obtained artificially from urine, and in large quantity from calcined bones; found naturally in some kinds of lead-ore; and in vast quantities in Spain united with calcareous earth. Assumes a solid form, and melts into glass.
11. *Acid of ants.* Procured from the animal from which it takes its name, by expression or distillation, in a fluid form.
12. *Acid of amber.* Obtained in a solid form from amber.
13. *Acid of arsenic.* Obtained from that substance by means of nitrous acid. Is extremely fixed in the fire.
14. *Acid of molybdæna.* Procured from that substance by means of nitrous acid. Resembles a fine white earth.
15. *Acid of lapis ponderosus, tungsten,* or *wolfram.* Obtained as an acid, *per se,* from this substance by Mr Scheele; but its real acidity is denied by other chemists. Is in the form of a yellow powder.
16. *Acid of milk.* Obtained in a fluid form from that liquor.
17. *Acid of sugar of milk.* Obtained in form of a white powder, by means of nitrous acid, from sugar of milk.
18. *Lithisiac acid* Obtained in a solid form from human calculus, by means of nitrous acid.
19. *Acid of benzoin.* Obtained in a solid form from that gum by sublimation or lixiviation with quicklime.
20. *Acid of lemons.* Obtained from the juice of that fruit by crystallization.
21. *Sebaceous acid,* or *acid of fat.* Obtained in a fluid state from suet by distillation.
22. *Acid of citrons.* Obtained in a fluid state from the juice of that and other fruits.
23. *Acid of apples.* Obtained in a fluid state from the juice of apples and other fruits.
24. *Acid of sorrel.* Obtained in a solid form from the juice of that plant; the same with acid of sugar.

II. *Alkalies.* These turn syrup of violets green, and with acids form neutral salts. They are,

1. *Fixed vegetable,* or *Pot-ash.* Always obtained from the ashes of burnt vegetables. A deliquescent salt.
2. *Fixed fossile.* A solid crystalline salt, sometimes found native, as the natrum of Egypt; and sometimes by burning seaweed as kelp.
3. *Volatile.* Obtained from sal ammoniac, from the soot of burning bodies, and from the putrefactive fermentation. It is naturally in the state of an invisible and elastic vapour, constituting a species of aerial fluid, and consists of phlogisticated and inflammable air.

Acids, by their union with other bodies, form

| *Neutral Salts.* | *Earthy Salts.* | *Metallic Salts.* | *Essential Salts.* |
|---|---|---|---|
| These are always composed of an acid and an alkali, and are of many different kinds, as may be seen in the following table. | Composed of an acid joined to an earthy basis, as alum and gypsum. See the following table. | Formed of an acid and metal. The principal of these are vitriols; the others may be seen in the following table. | Obtained from vegetables, and contain an acid joined with the juices of the plant in a particular manner not to be imitated by art. To these belong sugar, manna, honey, and others of that sort. |

II. EARTHS.

## II. EARTHS.

These are solid bodies, not soluble in water, nor inflammable; and if fused in the fire, never resume their earthy form again, but take that of glass. They are divided into *absorbent, crystalline,* and *argillaceous.*

I. *Absorbent Earths* are capable of being united with acids, and are either calcareous, or not calcareous.

*a,* The calcareous absorbent earths are,

1. *Limestone,* or *marble.* This is of infinite variety as to colour and texture. Marble is the hardest and finest. Those kinds of limestone which feel unctuous to the touch, are generally impregnated with clay: those that feel gritty, or where the lime is hard and weighty, contain sand; this is the best for building; the other for manure.
2. *Chalk.* A white, friable, soft substance. This is much more free of heterogeneous matters than any limestone, and is easily calcined into quicklime. It is probably nothing else than limestone suddenly concreted without being crystallized.
3. *Sea shells,* are likewise a calcareous earth, and yield a very fine quicklime. These are used in medicine.
4. *Terra ponderosa.* A fine white earth sometimes found combined with fixed air, but more commonly with the vitriolic acid; and forming with it a very heavy compound, named *spathum ponderosum.* It is found in mines and veins of rocks.

*b,* The absorbent earths which cannot be reduced into quicklime are,

1. *Magnesia alba.* A white earth, usually found combined with the vitriolic acid, and forming bitter purging salt. It is likewise obtained from the mother-ley of nitre, the ashes of burnt vegetables, *&c.*
2. *Earth of alum.* A particular kind of absorbent earth, found in many places mixed with sulphureous pyrites, as in Yorkshire, &c. Clay of any kind may by a particular process be converted into this earth.
3. *Earth of animals.* This is obtained by the calcination of animal substances, and by precipitation in the process for making acid of milk. It can hardly be converted into glass; and is therefore used as a basis for white enamels, &c. It is said to consist of the phosphoric acid united to calcareous earth.

II *Crystalline or Vitrescent Earths,* are hard, and strike fire with steel; may be calcined in the fire; but are not soluble in acids. Of this kind are,

1. *Sand* and *Flint*; found plentifully every where. With alkaline substances they are easily changed into glass; and hence are termed *vitrescent.*
2. *Precious stones* of all kinds are likewise referable to this class; but they are of a much greater degree of hardness and transparency than the others.

III. *Argillaceous Earths* are digstinguished by acquiring a very hard consistence when formed into a paste with water, and exposed to a considerable degree of heat; not soluble in acids. They are,

1. *Common clay.* It is of many different colours; but chiefly red, yellow, or white. The purest is that which burns white in the fire.
2. *Medical boles.* These are of different sorts; but are only a purer kind of clay, sometimes mixed with a little iron or other matters.
3. *Lapis nephriticus,* or *steatite.* These are indurated clays, found in various parts. They are at first soft and readily cut; but turn extremely hard in the air. Many other varieties of these earths might be mentioned; but as they do not differ in their chemical properties so much as in their external appearance, and being all mixed with one another, they more properly belong to the natural historian than the chemist.

## III. METALLIC SUBSTANCES.

These are bodies of a hard and solid texture; fusible in the fire, and resuming their proper form afterwards; not miscible with water, nor inflammable. They are divided into *Metals and Semimetals.*

I. *Metals* are malleable; and the species are,

1. *Gold.* The most ponderous and fixed in the fire of all bodies except platina, and the most ductile of any. It has a yellow colour, and is more commonly found in its metallic state than any other metal. It has no proper ore; but is found in ores of silver, and almost all sands contain some of it.
2. *Silver* is next to gold in malleability and ductility; but less fixed in the fire than either it or platina. It is sometimes found in its native state; but most commonly in that of an ore with sulphur, sometimes with arsenic, and assuming different appearances.
3. *Platina.* A white metal of a greater specific gravity than gold, and altogether as fixed in the fire; the most difficult to be melted of all known substances; resisting the tests which have usually been applied for discovering the purity of gold, supposed from hence to be the *smiris* of the ancients. Found in South America.
4. *Copper.* Of a reddish colour, hard and sonorous; admits of being extended greatly under the hammer, either hot or cold. Is difficult of fusion. It is generally found in the state of an ore with sulphur. There are a great variety of ores of it, extremely beautiful, blue, red, green, and yellow.
5. *Iron.* A grey-coloured metal, extremely ductile when hot; the lightest of them all except tin. It is the only metal certainly known to admit of being welded; though platina is likewise said to possess some share of this property. It is likewise the only one capable of being tempered by cooling. It is found almost every where; and its ores are infinitely various.
6. *Tin.* A white soft metal, the lightest of the whole, and very ductile. The ores of it are generally arsenical, and assume a crystalline appearance; their colour being most usually of a dark brown, and sometimes very beautiful.

7. *Lead.* A metal of a dull bluish colour, exceedingly soft and malleable, and very weighty. Seldom found in its metallic state, but usually in an ore with sulphur or arsenic; but seldom with sulphur alone. The principal ores of it are the cubic, called *galena* and the glassy, called *spar*.

8. *Mercury or quicksilver*; formerly accounted a semimetal, on account of its fluidity, but now reckoned among the most perfect metals. It is a white, opaque, metallic body; fluid, except in a very intense degree of cold; very heavy, and easily volatilized by heat. Sometimes found in its fluid form, but usually in a beautiful red ore with sulphur, called *cinnabar*.

II. SEMIMETALS are brittle, and do not stretch under the hammer. They are,

1. *Zinc.* A bluish white substance of a fibrous texture, considerably hard and sonorous, with a small degree of ductility; easily fused and volatilized. Its principal ore is lapis calaminaris.
2. *Bismuth* or *tin-glass.* A white ponderous, hard, brittle and sonorous body, of a plated texture; easily fused and vitrified. It is only reduced to an ore by arsenic. Its appearance much the same with regulus of antimony.
3. *Antimony.* A blackish substance, of a fibrous needle-like texture; hard, brittle, and of a considerable weight; not difficult of fusion, and easily convertible into glass. Its only ore is with sulphur, which is the crude antimony.
4. *Arsenic.* A bright, sparkling, whitish-coloured semimetal; of a plated texture; very brittle, and extremely volatile. It is generally found in the ores of others metals.
5. *Cobalt.* A brittle semimetal fusible in a moderate heat, and easily convertible into a beautiful blue glass, called *smalt.* It is always obtained from an arsenical ore, likewise called *cobalt.*
6. *Nickel.* A reddish white substance, of a close texture, and very bright; easily melted, but very difficult to vitrify.

## IV. INFLAMMABLE SUBSTANCES,

Are those which continue to burn of themselves when once set on fire. They are divided into *oils*, *sulphur* or *brimstone*, *alcohol* or *ardent spirits* and *charcoal.*

I. OILS are thickish, viscous fluids, not miscible with water. Divided into *animal*, *vegetable*, and *fossile.*

*a*, *b*, The animal and vegetable oils are,

1. *Expressed.* These are of a mild and bland taste, inodorous, and not soluble in alcohol. They are obtained by expression, as oil of olives, rape-seed, almonds, &c. Animal fats are of the same nature, as is also wax.
2. *Essential.* These are always obtained by distillation, possess the taste and flavour of the subject from whence they are drawn, and are soluble in alcohol. Of this kind are oil of cloves, spike, &c. The oil of ants is an example in the animal kingdom.
3. *Empyreumatic.* These are obtained by a considerable degree of heat, and possess an acrid taste and burnt-like flavour, as oil of hartshorn. They are soluble in spirit of wine.

*c*. *Fossile oils.* These are found in the earth in their native state; and are called, when pure, *naphtha*; which is of an acrid taste, and extremely volatile, not miscible with alcohol. A great many inflammable fossils contain this, as bitumens, pit-coal, &c.

II. SULPHUR or BRIMSTONE. This is a dry friable substance, not miscible with water. It is found in many mineral substances, metallic ores, &c. but is for the most part met with in pyrites. Great quantities of it are found in the neighbourhood of volcanoes.

III. ALCOHOL or ARDENT SPIRITS. This is a fluid of an acrid and volatile nature, miscible with water; obtained from fermented vegetable juices by distillation; as from the juice of the grape, malt-liquors, rice, &c.

IV. CHARCOAL. The residuum of most inflammable matters after undergoing distillation with a strong fire. A black substance, acted upon with difficulty by acids; soluble in hepar-sulphuris, and entirely dissipable into inflammable air by a very violent heat. Of great use as fuel, and essentially necessary in metallurgy and other arts.

## V. WATER.

A colourless insipid fluid well known. It is either *simple* or *mineral.*

I. SIMPLE, or *pure-rain-water*, as it called, though the most homogeneous fluid of this kind with which we are acquainted, is not perfectly pure, but always contains a portion of mucilaginous matter, which can never be perfectly separated. It is supposed to consist of dephlogisticated and inflammable air condensed.

II. MINERAL *waters* are these spring-waters impregnated with saline substances; the diversity of which is exceeding great; but they all agree in having an acid joined with them. The most common sorts are impregnated with iron and sulphur.

## VI. AIR.

An invisible and permanently elastic fluid, is of the following kinds: *Dephlogisticated, phlogisticated, fixed* or *fixable, inflammable, nitrous, vitriolic acid air, marine acid air, dephlogisticated marine acid, alkaline air, hepatic air, atmospherical air.*

1. *Dephlogisticated.* An elastic fluid naturally extricated in the process of vegetation; artificially procured from nitre, minium, manganese, water, &c. eminently capable of supporting flame and animal life. One of the component parts of our atmosphere.

2. *Phlogisticated.* Produced in great quantities during the putrefactive fermentation; obtained also in the calcination of metals and other phlogistic processes. Destroys animal life, and extinguishes flame, but is very friendly to vegetation. Is another of the component parts of our atmosphere.
3. *Fixed*, or *fixable.* Has its name from the property of adhering to certain bodies, and fixing itself in them. Consists of dephlogisticated air united to charcoal. Is obtained by fermentation, and in all phlogistic processes. Manifests the properties of an acid: extinguishes flame, and destroys animal life.
4. *Inflammable.* Consists wholly of charcoal and a little water rarefied by heat; is remarkable for being the lightest of all gravitating substances. Is produced naturally in mines, and from putrid waters; artificially procured from certain metallic solutions, by passing the steam of water over red-hot iron; by distilling wood, pit-coal, &c. with a strong heat; or by exposing charcoal to the heat of a burning lens *in vacuo.* It extinguishes flame unless it be mixed with a certain proportion of atmospherical or dephlogisticated air; in which case it explodes violently, destroys animal life, but is friendly to vegetation.
5. *Nitrous.* Procured artificially in dissolving metallic or other substances in the nitrous acid. On mixture with dephlogisticated air both the fluids lose their elasticity, and a small quantity of nitrous acid is produced. It instantly kills animals, and extinguishes flame. By union with some metals is converted into volatile alkali. In some cases it may be made to support flame, and even animal life. Its property of condensing along with phlogisticated air renders it a test of the salubrity of the atmosphere.
6. *Vitriolic acid air.* The same with volatile or sulphureous vitriolic acid.
7. *Marine acid air.* The same with marine acid reduced into vapour, and deprived of most of its water.
8. *Dephlogisticated marine acid.* Supposed by some to be the marine acid deprived of its phlogiston; by others to be the same acid with an addition of pure air. It destroys many kinds of colours; whitens linen, and with inflammable air regenerates common marine acid.
9. *Alkaline air.* The same with pure volatile alkali; is formed by an union of phlogisticated and inflammable air.
10. *Hepatic air.* Produced from the decomposition of liver of sulphur by acids, or in the common atmosphere. It is inflammable, but does not burn with explosion.
11. *Atmospherical air.* Composed of dephlogisticated and phlogisticated air; and thus supports both animal life and vegetation.

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## TABLE, showing the several Combinations that the SIMPLE CHEMICAL ELEMENTARY BODIES admit of with one another; the Compound resulting from that Mixture; and the Manner in which the Union is effected: With some Account of the principal Uses to which these are applied in Arts or Manufactures.

*N. B.* This mark*, put above any word, denotes that there is some difficulty in the process, or that the union is not very complete.

*VITRIOLIC ACID may be combined with the following substances*, viz.

**ACIDS.**
- NITROUS ACID. A mixture which readily inflames oils. By solution, generating heat.
- MURIATIC, VEGETABLE, and all other ACIDS yet known. By solution, generating heat. But these mixtures are applied to no particular use in medicine or arts.

**ALKALIES.**
- VEGETABLE.
  - *Vitriolated tartar.* By solution and crystallization, or double elective attraction from a great variety of bodies.
  - *Nitrum vitriolatum.* A vitriolated tartar, obtained by distilling from nitre with the vitriolic acid.
  - *Sal polychrestum.* By deflagrating nitre with sulphur. There are many other kinds of vitriolated tartar, known formerly by different names, and supposed to be possessed of particular properties, but they are now neglected.
- FOSSILE. *Glauber's salt.* By solution and crystallization. Much used in medicine as a gentle purgative.
- VOLATILE. *Secret ammoniac.* By solution. Formerly supposed a most powerful menstruum for metals, &c. but without any just foundation.

**EARTHS.**
- CALCAREOUS EARTHS.
  - A corroded calx. By simple corrosion. This when perfectly edulcorated with water is found to be a true gypsum.
  - *Selenites.* By precipitation from a very dilute solution of chalk in the nitrous acid, by means of the vitriolic acid.
  - *Terra ponderosa.* With this it unites in preference to alkalies, forming a very heavy and insoluble substance called *spathum ponderosum.*
  - *Gypsum* or *Paris-plaster.* Often found in a native state. May be artificially formed by precipitating from a solution of chalk in a very concentrated nitrous acid. Used as a cement: for taking impressions from medals, &c.
  - *Talc asbestos, &c.* A native production which connot be perfectly imitated by art. Used for holding objects in microscopes, making incombustible cloth, &c.
- MAGNESIA. *Epsom*, or *magnesia Glauber's salt.* By solution and crystallization. Much used in medicine for the same purposes as real Glauber's salt.

**EARTHS.**

- EARTH of ALUM. *Alum.* By ſolution, cryſtallization, &c. Uſed by dyers as a preparatory for taking on the colours, papermakers, goldſmiths, &c.
- EARTH of ANIMALS, OSTEOCELLA, &c. By ſolution. The mixtures of theſe are not applied to any particular uſe.
- CLAY*. *Alum.* By digeſting pure clay for ſome time in this acid, and expoſing it for ſome time to the air, an alum is produced; and if the clay is precipitated from this aluminous concrete, it is found to be a pure earth of alum, ſoluble in all acids.
- FLINT. A thickiſh coagulum. By digeſting the liquor ſilices in the vitriolic acid.

**METALS.**

- GOLD*. Imperfectly. By a particular proceſs after being ſeparated from aqua-regia.
- SILVER*. By ſolution, after it has been precipitated from the nitrous acid by alkalies. The fumes which ariſe in this ſolution are inflammable.
- COPPER. *Blue vitriol.* This is ſometimes a native production, but in this way it is never pure. It is artificially prepared by ſolution in a very concentrated acid, and cryſtallizing it.
- IRON.
  - *Green vitriol* or *copperas.* Obtained at large by particular proceſs from pyrites; or by ſolution, &c. in a diluted acid. This is the baſis of all black dyes, ink, &c. as it ſtrikes a black colour with vegetable aſtringents.
  - *Salt of ſteel.* By calcining the cryſtals of green vitriol till they are converted into a white powder.
  - *Colcothar of vitriol.* By continuing the calcination till it aſſumes a brown colour.
- LEAD.
  - *Saturnus vitriolicus.* A ſolution in a boiling heat, but is again precipitated when cold.
  - An indiſſoluble concrete. By precipitation from the nitrous acid.
- TIN. *Jupiter corroſivus.* By a boiling heat in a concentrated acid.
- MERCURY.
  - *Ignis Gehennæ*, or infernalis of Paracelſus. By a boiling heat, and repeated coctions with freſh acid when it is evaporated.
  - *Turpeth mineral*, or mercurius precipitatus flavus. By evaporating to dryneſs, and then waſhing with water.

**SEMIMETALS.**

- ANTIMONY*. *A metallic ſalt.* By elective attraction from butter of antimony.
- ZINC. *White vitriol.* Often found in its native ſtate. Artificially made by ſolution and cryſtallization in a diluted acid. Uſed by painters for drying.
- BISMUTH. A corroded calx. By ſolution in a concentrated acid.
- ARSENIC - - - By ditto.
- COBALT. A roſe-coloured mixture. By ſolution. If this is precipitated by a fixed alkali, and again diſſolved, the liquor appears of a beautiful red.

**OILS.**

- EXPRESSED. A blackiſh gummy-like maſs. By ſolution, generating a conſiderable heat. Native gums are ſuppoſed to owe their origin to a mixture of this kind.
- ESSENTIAL. A dark-coloured reſinous maſs. A great heat and violent efferveſcence being produced by this mixture. Native reſins ſuppoſed the ſame.
- EMPYREUMATIC. Little known. By ſolution.
- FOSSILE. A ſubſtance reſembling amber. By ſolution.

**SULPHUR*.** Here there is no proper union of ſubſtances; but if ſulphur is boiled in this acid, it becomes leſs inflammable and more fixed than any ordinary ſulphur.

**ALCOHOL.**

- *Vitriolic ether.* By careful ſolution and diſtillation, the ether being ſeparated by the addition of water.
- *Spiritus vitrioli dulcis.* By ſolution and diſtillation.
- *Oleum dulce.* By continuing the heat after the ether has ariſen.
- *Oleum anodynum minerale.* By rediſtilling the reſiduum of the laſt with alcohol. A medicine much celebrated by Hoffman.
- *Sulphur.* By puſhing the heat after the oil comes over. It is to be obſerved that this is produced in every combination of this acid with inflammables or metals.

**WATER.** An acidulated water. Sometimes, though ſeldom, found iſſuing along with native ſprings. Applied to no particular uſe.

*NITROUS ACID may be combined with the following Subſtances, viz.*

**ACIDS.**

- VITRIOLIC, as above.
- MURIATIC. *Aqua-regia.* By ſolution. This is the only proper menſtruum for gold; and it is a ſolution of tin in this menſtruum which is the baſis of the ſcarlet dye.
- VEGETABLE, and all others. By ditto. Theſe compounds have no particular names, nor are applied to any particular uſes in medicine or arts.

**ALKALIES.**

- VEGETABLE. *Common nitre.* A native production. Made artificially by ſolution and cryſtallization. This deflagrates with oily or metallic bodies, and is the foundation of gun-powder.
- FOSSILE. *Cubic nitre.* By ſolution.
- VOLATILE. *Nitrous ammoniac.* By ſolution. This differs from all the other ammonical ſalts, by being ſoluble in alcohol.

**EARTHS.**

- CALCAREOUS.
  - *Deliqueſcent cryſtals.* By ditto and cryſtallization.
  - *Baldwin's phoſphorus.* By ditto and evaporating to dryneſs.
- EARTH of ALUM, and all other abſorbent earths. By ſolution. The compounds have no names nor any remarkable properties hitherto diſcovered.
- CRYSTALLINE EARTHS*. By ſolution after precipitation from the liquor ſilices.

**METALS.**

- GOLD*. *Slightly impregnated.* By a boiling heat in close vessels, after the ordinary method of separating silver from gold by the nitrous acid. It spontaneously subsides in the air.
- SILVER.
  - *A fluid solution.* By solution. This when diluted with water stains hair and bones black; as also marble, agate, jasper, &c. of different colours.
  - *Sal metallorum.* By solution and crystallization.
  - *Catharticum lunare, lunar caustic,* or *lapis infernalis.* By inspissating the solution to dryness.
- COPPER. A green-coloured solution. By solution.
- IRON. A greenish solution, if a diluted acid is employed; if otherwise, it is of a yellowish colour: evaporated to dryness, it deliquates in the air.
- LEAD.
  - A yellow solution. By dissolving in a diluted acid. If much water is added, the metal is precipitated.
  - *Saturni fulminans.* By inspissating the solution. This explodes when put upon the fire with greater force than nitre, and has been proposed to be used as an ingredient in gun-powder to augment its force.
- TIN. A solution or corroded calx. By a careful solution without heat it remains suspended; if otherwise, it falls down in form of a calx. This is commonly supposed to be the composition used in dyeing scarlet; but by mistake: for it is a solution of tin in aqua-regia that communicates that fine colour to cochineal. The same solution is the basis of the powder which tinges glass of a ruby colour. It is the precipitate of gold from aqua-regia by means of tin.
- MERCURY.
  - A limpid solution, intensely corrosive. By solution.
  - *Red precipitate.* By evaporating the solution to dryness, and then calcining till it becomes red.
  - *Mercurius corrosivus fusus.* By precipitating from the nitrous acid by fixed alkali.
  - *White precipitate* - By ditto with the volatile alkali.

**SEMIMETALS.**

- BISMUTH.
  - A greenish solution. By using a concentrated acid. This might be applied in some cases in the art of dyeing; but is not yet come into general use.
  - *Magistery of bismuth.* By precipitating from the solution by means of water. This has been employed as a cosmetic, but is inefficacious and unsafe. If mixed with pomatum, this stains hair of a dark colour without injuring it.
- ZINC. A corroded solution. By the ordinary means.
- ANTIMONY.
  - A colourless calx. By simple corrosion.
  - *Bezoardic mineral.* By distilling from butter of antimony, after having added the nitrous acid.
  - *Antimonium diaphoreticum.* By adding nitre to crude antimony, and deflagrating.
  - *Cerusa antimonii.* By deflagrating regulus of antimony with nitre.
- COBALT.
  - A red liquor. By solution either in its calcined or metallic state.
  - *Rose-coloured crystals.* By adding muriatic acid, and allowing it to crystallize.
  - *Green sympathetic ink.* By dissolving these crystals in water. The solution is red when cold, and green when warm; when wrote with, it disappears when dry; but when held to the fire it becomes green; and again disappears when cold.
- NICKEL. A green-coloured liquor. By solution.

**OILS.**

- EXPRESSED. A thick bituminous-like substance. Upon the mixture a considerable degree of heat is generated, and sometimes, though very seldom, actual flame is produced.
- ESSENTIAL. Ditto. A more violent heat is generated upon the mixture with these oils than any other, and with many of them an actual flame is produced.
- EMPYREUMATIC. This mixture has no name, nor is it applied to any remarkable use in arts.
- FOSSILE. Ditto.

**ALCOHOL.**

- *Nitrous ether.* By digesting; the ether arising to the surface.
- *Spiritus nitri dulcis.* By digesting a little, and then distilling.

**WATER.** *Acidulated water.* By solution.

*The* MURIATIC ACID *may be combined with the following Substances.* viz.

**ACIDS.**

- VITRIOLIC and NITROUS. As in the former part of this Table.
- VEGETABLE, and all others yet known. By solution: but as none of these mixtures are applied to any particular purpose, we take no notice of them.

**ALKALIES.**

- VEGETABLE. *Digestive salt.* By solution and crystallization.
- FOSSILE.
  - *Common salt.* Commonly obtained by evaporating sea-water to dryness; or artificially made by mixing the acid and alkali, and crystallizing.
  - *Sal gem.* A native fossile salt, found in mines in Poland, Spain, *&c.* of the same nature as common salt, but more pure.
- VOLATILE. *Common ammoniac.* Obtained at large by a particular process from soot. Artificially made by mixing the acid and alkali, and crystallizing.

**EARTHS.**

- CALCAREOUS.
  - *Liquid shell.* By solution. A substance whose effects in medicine have been greatly extolled.
  - *Ol. calcis per deliquium.* By evaporating liquid shell to dryness. It naturally deliquesces.
  - *Fixed ammoniac.* By solution and crystallization. This sometimes appears luminous in the dark when struck with a hammer.
- OSTEOCELLA, MAGNESIA, and other absorbents. By solution: but the properties or uses of these are not known.

METALS.

GOLD*, *A yellow liquor.* By boiling a calx of gold (in whatever way obtained) in this acid. It does not act upon it in its metallic state.

SILVER*. *A fluid solution.* By dissolving the ore of silver in this acid. It does not act upon pure metallic silver. — *Luna cornea.* By elective attraction from the nitrous acid.

PLATINA*. A fluid solution. With difficulty effected, after having been precipitated from aqua-regia by alkalies.

COPPER. *A green deliquescent inflammable salt.* By solution and inspissating to dryness.

IRON. *Tinctura martis aurea.* By solution. The iron is in some measure rendered volatile by the operation.

LEAD. A limpid solution. By a boiling heat, and frequent cohobations with fresh acid. — *Cornea Saturni.* By precipitation from the nitrous acid.

TIN*. A corroded powder. By simple corrosion. — *Butter of tin.* By distilling from corrosive sublimate.

MERCURY*. A colourless crystalline mass, extremely acrid. By corrosion, employing the fumes of a very concentrated acid. — *Mercur. corrosiv. albus.* By precipitation from the nitrous acid. — *Corrosive sublimate.* By subliming from sal ammoniac, common salt, or many other bodies. — *Mercurius dulcis.* By resubliming corrosive sublimate with more quicksilver. — *Mercurial panacea.* By subliming corr. sub. nine times, and digesting for some time in spirit of wine.

SEMIMETALS.

BISMUTH*. A solution very slightly impregnated. By employing a very concentrated acid.

ZINC. A solution of a very slight yellow colour.

ARSENIC*. *Butter of arsenic.* By distilling corrosive sublimate with arsenic; the arsenic uniting with the acid, and leaving the mercury.

COBALT. A reddish solution. By the ordinary means. It becomes green by a gentle heat.

NICKEL. A green solution. By the ordinary means.

OILS*. By solution. The union here is but imperfect, nor have they any particular name.

ALCOHOL. *Spiritus salis dulcis.* By digestion, and afterwards distilling. The acid here is never totally dulcified.

WATER. *Acidulated water.* Generating heat by mixture.

### *VINEGAR may be combined with the following Substances,* viz.

ACIDS. VITRIOLIC, NITROUS, and MURIATIC, as in the above table. It likewise unites with all other acids, generating heat; but the properties or uses of these are not known.

ALKALIES.

VEGETABLE. *Regenerated tartar.* By solution and crystallization.

FOSSILE. *Polychrest of Rochelle.* By ditto.

VOLATILE. *Spiritus Mindereri* By solution.

EARTHS.

CALCAREOUS EARTH. *Earthy salts.* Not known in medicine or arts.

MAGNESIA. *Dr Black's purging salt.* By solution. It unites with all the other absorbent earths; but the properties of these mixts are unknown.

METALS.

COPPER. *Verdegris.* By solution and crystallization; or at large, by stratifying copper-plates with the husks of the grape.

IRON. *Sal martis aperiens.* By solution and crystallization.

LEAD. *Ceruse.* By exposing, in certain circumstances, thin plates of lead to the fumes of vinegar. — *Saccharum Saturni.* By solution and crystallization.

TIN*. This is not properly dissolved; but the acid is evidently impregnated. By the ordinary means of solution.

MERCURY*. *A fluid solution.* By employing a precipitate of mercury from the nitrous acid by alkalies. — *A red calx.* By long digestion with fluid mercury.

SEMIMETALS.

ZINC. A colourless solution of a sweetish taste. By digesting for some time.

ANTIMONY*. *Vinum benedictum.* This it not a proper solution of the metal, but the acid is impregnated with an emetic quality.

ARSENIC. *Vinum arsenicum.* By ditto. A curious phosphoric liquor.

BISMUTH. An austere styptic liquor. By strong coction.

OILS*. The union here is imperfect, nor have any of them obtained particular names.

ALCOHOL. A mixture much used for anointing sprains, &c.

WATER. *Acidulated water.*

### *ACID OF TARTAR may be combined with the following substances,* viz.

ALKALIES. VEGETABLE. Cream of tartar with excess of acid. — Soluble tartar, when completely saturated.

ALKALIES.

FOSSILE. Rochelle salt.

VOLATILE. A salt very difficult of solution with excess of acid. — A beautiful and soluble salt when perfectly saturated.

EARTH.

EARTH. CALCAREOUS. An indiſſoluble ſelenite.

METALS. COPPER. A fine green colour for painting.
IRON. A green aſtringent liquid. Chalybeated tartar.

SEMIMETAL. REGULUS of ANTIMONY. Emetic tartar.

*ACID of URINE may be combined with the following ſubſtances,* viz.

ACIDS of all kinds. The nature of theſe not known.

ALKALI.
FIXED VEGETABLE. A ſalt not eaſily cryſtallized, the nature of which is not known.
FOSSILE. A fine cryſtallized ſalt uſed in medicine.
VOLATILE. A glaſs-like ſaline ſubſtance called *microcoſmic ſalt*. The acid is always found in this ſtate by evaporating urine.

VITRESCENT EARTHS. A glaſs of different ſorts. By fuſion.

METALS.
LEAD. An inflammable malleable maſs. By calcining the dry ſalt with lead.
TIN. A maſs reſembling zinc; and inflammable. By ditto.
IRON. A true *phoſphorus*. By ditto.
A bluiſh ſolution. By employing a watery ſolution of the acid.
COPPER. A corroded powder, or green ſolution. By a boiling heat in a watery ſolution of the acid.
MERCURY. A ſemi-opaque maſs. By fuſion with the acid, in its ſolid form.

SEMIMETALS.
ZINC. A corroded powder, ſoluble in water. By ſolution in the acid in a watery ſituation.
A true *phoſphorus*. By fuſion with the dry acid.
ANTIMONY. A ſolution in the ordinary way.
A brilliant ſtriated maſs. By fuſion with the dry acid.
BISMUTH. A mixture but little changed in appearance from ordinary biſmuth. By fuſion.
ARSENIC. A whitiſh ſemitranſparent deliqueſcent maſs. By fuſion.
COBALT. A reddiſh tincture. By ſolution.

OILS. *Baldwin's phoſphorus.* By diſtilling with ſubſtances that contain oils or inflammable matter.

*FLUOR ACID, may be combined with the following Subſtances,* viz.

ALKALIES.
FIXED VEGETABLE. A gelatinous ſaline maſs which cannot be cryſtallized. Great part of it is alſo diſſipated by evaporation to dryneſs.
FOSSILE. A ſubſtance ſimilar to the foregoing.
VOLATILE. Lets fall a quantity of ſiliceous earth, and forms a cryſtallizable ammoniacal ſalt.

EARTHS.
LIME, MAGNESIA, EARTH of ALUM. A gelatinous matter.
SILICEOUS EARTH. After long ſtanding, cryſtals of quartz.

METALS.
SILVER, QUICKSILVER. The calces of theſe metals partially diſſolved; but the properties of the ſolution unknown
COPPER. The calx eaſily ſoluble, and affording blue cryſtals; the metal only partially ſo.
IRON. Diſſolved with violence with the emiſſion of inflammable vapours into an uncryſtallizable liquor.

*ACID of SUGAR may be combined with the following Subſtances,* viz.

ALKALIES.
FIXED VEGETABLE. A ſalt ſcarce capable of cryſtallization when perfectly neutral.
FOSSILE. A ſalt difficultly ſoluble in water.
VOLATILE. An ammoniacal ſalt ſhooting into quadrangular priſms.

EARTHS.
LIME. A kind of ſelenite from which the acid cannot be ſeparated by a burning heat.
TERRA PONDEROSA. A ſalt formed into angular cryſtals, ſcarce ſoluble in water.
MAGNESIA. A white powder inſoluble without an exceſs of acid.
EARTH of ALUM. A yellow pellucid maſs incapable of cryſtallization, and liquefying in the air.

METALS.
GOLD, SILVER, PLATINA, QUICKSILVER. The calces of all theſe metals diſſolved, but the nitre of the ſolutions unknown.
IRON. Diſſolved in great quantity, and forming a yellow priſmatic ſalt eaſily ſoluble in water.

SEMIMETAL. COBALT. A yellow-coloured ſalt forming a ſympathetic ink with ſea-ſalt.

INFLAMMABLES. ALCOHOL. An ether which cannot eaſily be ſet on fire unleſs previouſly heated, and burning with a blue flame.

*ACID of BORAX or SEDATIVE SALT may be combined with the following Subſtances,* viz.

ALKALIES.
FOSSLE. *Borax.* A native ſubſtance, which may be imitated by art. It is of great uſe in promoting the fuſion of metals and earths.
VOLATILE. An ammoniacal ſalt ſhooting into ſmall cryſtals, and melting by an intenſe heat into a greyiſh-coloured glaſs.

EARTHS.
MAGNESIA. A ſalt cryſtallizable in vinegar and acid of ants. Decompoſed by other acids and ſpirit of wine.
EARTH of ALUM. In certain proportions a ſalt difficult of ſolution; in others a hard maſs reſembling pumice-ſtone, yet partially ſoluble in water.

METALS.

| | |
|---|---|
| METAL. | IRON. An amber-coloured ſolution yielding cryſtals of a yellow colour. |
| SEMIMETAL. | ARSENIC. A cryſtallizable compound ſhooting into pointed ramifications, or forming a greyiſh, white, or yellow powder. |
| ALCOHOL. | A ſolution with a conſiderable heat, which burns with a green flame. |
| WATER. | A ſolution in a conſiderable heat. The other mixtures with this acid not known. |

*ACID of AMBER may be combined with the following Subſtances*, viz.

| | |
|---|---|
| ALKALIES. | FIXED VEGETABLE. A tranſparent and cryſtallizable ſalt, but deliqueſcent. |
| | FOSSILE. A cryſtallizable ſalt not deliqueſcent. |
| | VOLATILE. An ammoniacal ſalt ſhooting into acicular cryſtals. |
| EARTHS. | LIME. A cryſtallizable ſalt, difficult of ſolution and not deliqueſcent. Decompoſed by common ſal ammoniac. |
| | MAGNESIA. A gummy deliqueſcent ſaline maſs, not cryſtallizable. |
| | EARTH of ALUM. A priſmatic ſalt incapable of decompoſition by alkalies. |
| METALS. | SILVER. A ſalt ſhooting into thin oblong cryſtals obtained from the precipitate; but no ſolution of the perfect metal. |
| | COPPER. A cryſtallizable ſalt of a green colour. |
| | IRON. A cryſtallizable ſalt of a brown colour. |
| | TIN. A cryſtallizable ſalt from the precipitate, ſcarce to be decompoſed by alkalies. |
| | LEAD. A cryſtallizable ſalt from the precipitate. |
| SEMIMETALS. | ZINC. A cryſtallizable ſalt. |
| | BISMUTH. A cryſtallizable ſalt from the precipitate, not to be decompoſed by alkalies. |
| | REGULUS of ANTIMONY. A ſolution of the precipitate. |

*ACID of ANTS may be combined with the following Subſtances*, viz.

| | |
|---|---|
| ALKALIES. | FIXED VEGETABLE. A cryſtallizable ſalt, deliqueſcent in the air. |
| | FOSSILE. A ſalt of a ſimilar nature. |
| | VOLATILE. An ammoniacal liquor, cryſtallizable with difficulty. |
| EARTHS. | CHALK or CORAL. A cryſtallizable ſalt which does not deliquate. |
| | MAGNESIA. A ſaline liquor ſcarcely cryſtallizable. |
| | TERRA PONDEROSA. A cryſtallizable ſalt which does not deliqueſce. |
| | EARTH of ALUM. Unites with difficulty, and ſcarcely to the point of ſaturation. The nature of the compound not known. |
| METALS. | SILVER*. By ſolution. The calx of ſilver precipitated from aquafortis by alkalies; but does not act upon it in its metallic ſtate. |
| | COPPER. Beautiful green cryſtals. By diſſolving and cryſtallizing calcined copper. It acts ſlowly upon it in its metallic ſtate. |
| | IRON. A cryſtallizable ſalt. It diſſolves this metal with great facility. |
| | LEAD*. A ſalt reſembling ſaccharum ſaturni. By diſſolving the red calx of lead. But it does not act upon it in its metallic ſtate. |
| SEMIMETAL. | ZINC. Elegant cryſtals. By the ordinary means. |

The effects of this acid upon other bodies, or the uſes to which theſe combinations might be applied, are not yet ſufficiently known.

*ACID of ARSENIC may be combined with the following Subſtances*, viz.

| | |
|---|---|
| ALKALIES. | FIXED VEGETABLE. A ponderous ſalt ſhooting into fine cryſtals by ſuperſaturation with acid. |
| | FOSSILE. A ſalt cryſtallizable when perfectly neutral. |
| | VOLATILE. A peculiar kind of ammoniacal ſalt parting with the alkali, and decompoſing ſome of it in a ſtrong fire. |
| EARTHS. | CHALK. A cryſtallizable ſalt ſcarcely ſoluble. |
| | MAGNESIA. A gelatinous maſs which cannot be cryſtallized. |
| | TERRA PONDEROSA. An inſoluble white powder. |
| METALS. | COPPER. A green-coloured ſolution. |
| | IRON. A very thick gelatinous ſolution. |
| | LEAD. A ſolution which cannot be cryſtallized. |
| | TIN. A gelatinous ſolution in the moiſt way. A mixture taking fire in cloſe veſſels in the dry way. |
| SEMIMETALS. | ZINC. A ſolution in the moiſt way, and in the dry, a mixture taking fire in cloſe veſſels. |
| | BISMUTH. A partial ſolution. |
| | REGULUS of ANTIMONY. A partial ſolution. |
| | COBALT. A partial ſolution of a red colour. |
| | MANGANESE. A partial ſolution in its natural ſtate. When the mangaueſe is phlogiſticated, a cryſtallizable ſalt may be obtained. |
| INFLAMMABLES. | CHARCOAL. A mixture taking fire and ſubliming when heated in cloſe veſſels. |
| | OIL of TURPENTINE, &c. A thick black ſubſtance after ſome days digeſtion. |
| | SULPHUR. A red ſublimate. |

*ACID of MOLYBDÆNA may be united with the following Substances,* viz.

| | |
|---|---|
| ALKALI. | FIXED VEGETABLE. A cryſtallizable ſalt.<br>VOLATILE. A neutral ſalt, the nature of which is unknown. |

*ACID of MILK may be combined with the following Subſtances,* viz.

| | |
|---|---|
| ALKALIES. | FIXED VEGETABLE. A deliqueſcent ſalt ſoluble in alcohol.<br>FOSSILE. A ſalt of a ſimilar nature.<br>VOLATILE. A deliqueſcent ſalt parting with much of the alkali by heat. |
| EARTHS. | CALCAREOUS and ARGILLACEOUS. Deliqueſcent ſalts.<br>MAGNESIA. A ſalt more eaſily cryſtallized, but deliqueſcent. |
| METALS. | COPPER. A blue ſolution, which cannot be cryſtallized.<br>IRON. A brown ſolution, with the emiſſion of inflammable air, yielding no cryſtals.<br>LEAD. An aſtringent ſweetiſh ſolution, which does not cryſtallize. |
| SEMIMETAL. | ZINC. A cryſtallizable ſalt, with the emiſſion of inflammable air during the ſolution. |

*ACID of SUGAR of MILK may be combined with the following Subſtances,* viz.

| | |
|---|---|
| ALKALIES. | FIXED VEGETABLE. A ſalt very difficult of ſolution.<br>FOSSILE. A ſalt more eaſily ſoluble.<br>VOLATILE. A peculiar kind of ammoniac. |
| EARTHS. | ABSORBENT and ARGILLACEOUS. Inſoluble ſalts. |

*ACID of APPLES may be combined with the following Subſtances,* viz.

| | |
|---|---|
| ALKALIES. | FIXED VEGETABLE, FOSSILE, and VOLATILE. Deliqueſcent ſalts. |
| EARTHS. | CALCAREOUS. A ſalt difficult of ſolution unleſs the acid prevail.<br>MAGNESIA. A deliqueſcent ſalt.<br>EARTH of ALUM. A ſalt very difficult of ſolution. |
| METAL. | IRON. A brown ſolution, which does not cryſtallize. |
| SEMIMETAL. | ZINC. A fine cryſtallizable ſalt. |

*ACID of FAT may be combined with the following Subſtances,* viz.

| | |
|---|---|
| ALKALIES. | FIXED, VEGETABLE, and FOSSILE. Neutral ſalts of a particular nature.<br>VOLATILE. A concrete volatile ſalt. |
| EARTHS. | CALCAREOUS. A cryſtallizable ſalt of a brown colour.<br>MAGNESIA. / EARTH of ALUM. A gummy maſs, which refuſes to cryſtallize. |
| METALS. | SILVER. A ſolution of the calx.<br>PLATINA. The calx copiouſly diſſolved, and even the perfect metal attacked by diſtillation to dryneſs.<br>COPPER. A green ſolution, which cannot be cryſtallized.<br>IRON. A cryſtallizable ſalt, which does not deliquate.<br>LEAD. An aſtringent ſolution of the red calx called *minium.*<br>TIN. A ſolution in ſmall quantity.<br>MERCURY. A ſolution by being twice diſtilled from the metal. |
| SEMIMETALS. | ZINC. Diſſolved in its metalline ſtate.<br>BISMUTH. A ſolution of precipitate.<br>REGULUS of ANTIMONY. A cryſtallizable ſalt, which does not deliquate.<br>MANGANESE. A perfect and clear ſolution. |

*ACID of BENZOIN may be combined with the following Subſtances,* viz.

| | |
|---|---|
| ALKALIES. | FIXED VEGETABLE. A ſalt ſhooting into pointed feathery cryſtals.<br>FOSSILE. A ſalt procurable in larger cryſtals.<br>VOLATILE. A deliqueſcent ſalt ſcarce cryſtallizable. |
| EARTHS. | CALCAREOUS. A cryſtallizable ſalt not eaſily ſoluble.<br>MAGNESIA. A cryſtallizable ſalt eaſily ſoluble. |

*The FIXED ALKALI, whether VEGETABLE or FOSSILE, can be united with the following Bodies; but the Vegetable is beſt known.*

| | |
|---|---|
| ACIDS: | Vitriolic, Nitrous, Muriatic, Vegetable; and acid of Urine, of Amber, of Ants, of Borax, &c. as in the former part of this Table. |
| ALKALIES | of all ſorts. The uſes of theſe mixtures are not known. |
| EARTHS. | CRYSTALLINE. *Liquor ſilicum.* By fuſion with twice their weight of alkali. *Glaſs.* By fuſion with a much ſmaller proportion of alkali. This is the compoſition of cryſtal glaſs, and all others commonly uſed.<br>ABSORBENTS. Argillaceous, and all kinds of earths. *Glaſs.* By fuſion; differing in quality according to the nature of the ingredients. Glaſs is likwiſe produced with it in fuſion with metals. |
| METALS. | GOLD*. After having precipitated it from aqua-regia, it diſſolves it if the alkali has been calcined with animal ſubſtances.<br>SILVER*. After having precipitated it from the nitrous acid, it diſſolves it if the alkali has been calcined in contact with the flame. |

**METALS.**

- **Tin.** A corroded powder. By the ordinary means of ſolution.
- **Copper.** By ditto.
- **Lead.** A fluid ſolution. By ditto. This ſtains hair black.
- **Iron*.** A blood-coloured ſolution. By dropping a ſolution of iron in the nitrous acid, into an alkaline lixivium.
- **Mercury*.** A fluid ſolution. After precipitating it from acids; if the alkali is in too large proportions, it then diſſolves it, eſpecially if the alkali has been calcined in contact with the flame.

**SEMIMETALS.**

- **Zinc*.** By ſolution, after having precipitated it from the nitrous acid.
- **Bismuth*.** By ſolution, after having precipitated it from the nitrous acid.
- **Antimony.**
  - *Kermes mineral.* By diſſolving antimony in an alkaline lixivium, filtering, and allowing it to ſtand in a cool place till it precipitates.
  - *Golden ſulphur of antimony.* By diſſolving a crude antimony in an alkaline lixivium, and precipitating by an acid.
  - *Hepar antimonii.* By deflagrating crude antimony with nitre.
  - *Crocus metallorum.* Is hepar antimonii pulveriſed and edulcorated with water.
  - *Diaphoretic antimony.* By deflagrating regulus of antimony with nitre.
  - *Antimoniated nitre.* By diſſolving diaphoretic antimony in water, and allowing it to cryſtallize.
  - *Magiſtery of antimony.* By precipitating a ſolution of diaphoretic antimony by adding vinegar.
  - *Regulus antimonii medicinalis.* By fuſing crude antimony with alkali. This is not properly a compound of alkali and antimony, but of another kind. But as it is a term much uſed, it was proper to explain it.
- **Arsenic*.** A metallic arſenical ſalt. By a particular elective attraction from regulus of antimony and nitre.

**OILS.**

- **Expressed.** *Soap.* The beſt hard ſoap is made of olive-oil and foſſile alkali. The ordinary white ſoap of this country is made of tallow and potaſh; black ſoap with whale-oil and potaſh.
- **Essential.** *Saponaceous maſs.* Beſt made by pouring ſpirit of wine upon cauſtic alkali and then oil, digeſting and ſhaking.
- **Empyreumatic.** This mixture diſſolves gold when precipitated from aqua regia; and is the baſis of the fine colour called *Pruſſian blue;* and has various other properties, as yet but little known.
- **Fossile.** This has no name, nor are the properties well known; but from ſome obſervations that have been made on native ſoapy waters, it is probable that it would keep linen much longer white than any other kind of ſoap.

**SULPHUR.**

- *Hepar ſulphuris.* By injecting alkalies upon melted ſulphur.
- *Lac ſulphuris.* By diſſolving ſulphur in an alkaline lixivium, and precipitating by an acid.

**WATER.** *Alkaline lixivium,* when cauſtic, or even the ordinary ſolution of mild alkali, is a fluid of great power in waſhing, bleaching, &c.

**AIR.** **Fixed.** *Mild alkali.* This is the general ſtate in which alkalies are found; but if they are rendered cauſtic by means of quick-lime or otherwiſe, they again abſorb it from the air, or from many other bodies, by elective attraction. When perfectly mild, this alkali may be made to aſſume a cryſtalline form.

*The VOLATILE ALKALI, or SPIRIT OF SAL AMMONIAC, can be united with theſe Bodies,* viz.

**ACIDS:** Vitriolic, Nitrous, Muriatic, Vegetable; of Urine, of Amber, of Ants, &c.

**ALKALI,** as above.

**METALS.**

- **Gold*.**
  - *Aurum fulminans.* A powder obtained by precipitating it from aqua regia by volatile alkalies.
  - A liquid ſolution. By adding a large proportion of alkali after it has been precipitated from aqua regia. This depoſites the gold when long expoſed to the air. The curious vegetation called *arbor Dianæ* is formed by adding mercury to this ſolution. A violently fulminating powder obtained by digeſtion.
- **Silver*.** A ſolution. After it has been precipitated from the nitrous acid. A fulminating powder by digeſtion.
- **Platina*.** By ſolution, after having precipitated it from aqua regia.
- **Copper.**
  - A blue-coloured ſolution. By the ordinary means. This when evaporated to dryneſs, and mixed with tallow, tinges the flame green.
  - Sapphire-coloured cryſtals. By cryſtallizing the ſolution.
  - *Venus fulminans.* By evaporating the ſolution to dryneſs.
  - *Aqua cerulea ſapphirina.* By mixing ſal ammoniac, quick-lime, and thin plates of copper, with water, and allowing them to remain a night.
- **Iron.** By ordinary ſolution.
- **Lead.** By ditto.
- **Tin.** The mixts that are produced by theſe metals are little known.

**SEMIMETALS.**

- **Bismuth*.** By ſolution, after having precipitated it from the nitrous acid.
- **Antimony.**
- **Cobalt.** A reddiſh liquor. By ſolution.
- **Nickel.** A blue liquor. By ditto.

**OILS.**

- **Expressed.** Has no name. By ſolution.
- **Essential.** *Sal volatile oleoſum.* By ditto with ſome difficulty, unleſs the alkali is in a cauſtic ſtate.
- **Empyreumatic.** A pungent oily ſubſtance, of great power in medicine. The principal one of this kind in uſe is ſpirit of hartſhorn.
- **Fossile.** A particular kind of ſoapy ſubſtance.

SULPHUR. Smoking spirit of sulphur. By distilling sal ammoniac, quick-lime, and sulphur.
ALCOHOL*. By distilling alcohol from volatile alkalies, it acquires a caustic fiery taste ; but the union is not complete.
WATER. This solution might be of use in washing or bleaching; but, unless in particular cases, would be too expensive. It coagulates with alcohol.
AIR. Fixed. Mild volatile alkali. The usual state in which it is found ; nor has any method yet been discovered of rendering it solid but in this state.

*EXPRESSED OILS may be combined with the following Substances*, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, as in the foregoing part of this Table.
ALKALIES: Fixed and Volatile, as above.
CALCAREOUS EARTHS. A kind of plaster. By mixture when in a caustic state.
METALS. { Tin*. Ditto. By solution when the tin is in the state of a calx.
Lead*. Ditto. By boiling the calx of lead in oils. This is used for cements in water-works. The common white paint is a mixture of this less perfect. }
SEMIMETALS. Zinc*. Ditto. By ditto.
OILS: Essential, Empyreumatic, and Fossile. By mixture but their uses are not much known.
SULPHUR, *Balsam of Sulphur*. By solution in a boiling heat.
ALCOHOL. After expressed oils are freed from soap or plasters, they are soluble in alcohol; but not in their ordinary state.

*ESSENTIAL OILS may be combined with the following Substances*, viz.

ACIDS: Vitriolic, Nitrous, &c. as above.
ALKALIES: Fixed and Volatile, as above.
METALS. { Copper. By solution.
Lead. By ditto. }
OILS of all kinds. By solution or mixture.
SULPHUR. A balsam of sulphur. By solution, imperfectly ; better by adding essential oils to the solution made by expressed oils or hepar sulphuris.
ALCOHOL. { Imperfect mixture. By solution.
Aromatic waters. By distillation. }
WATER. Distilled water of the shops. By distilling recent vegetable substances with water.

*EMPYREUMATIC OILS may be combined with the following Substances*, viz.

ACIDS: Vitriolic and Nitrous, as above.
ALKALIES: Fixed and Volatile, as above.
OILS of all kinds. By mixture.
ALCOHOL. By solution. By repeated distillations the oils are rendered much more subtile.

*FOSSILE OILS may be combined with the following Substances*, viz.

ACIDS: Vitriolic and Nitrous, as above.
ALKALIES: Fixed and Volatile, as above.
OILS of all kinds. By mixture.
SULPHUR. With some difficulty, by solution.
ALCOHOL. - - - By ditto.

*SULPHUR may be combined with the following, Substances*, viz.

ACID*: Vitriolic; with the phenomena above described.
ALKALIES: Fixed and Volatile, as above.
METALS. {
Silver. A mass of red-like colour. By adding sulphur to red-hot silver, and fusing ; found also with it in the state of an ore.
Lead. A sparkling friable mass, hardly fusible. By deflagrating sulphur with lead. This in a native state forms the ore of lead called *galena*.
Copper. A Black brittle mass, easily fused. By adding sulphur to red-hot copper, or stratifying with sulphur and fusing. Naturally in some yellow pyrites.
Iron. { A spungy-like dross, easily fusible. By putting sulphur to red-hot iron. This is also found naturally in the common yellow or brown pyrites.
A fulminating compound. By mixing filings of iron with sulphur, moistening them with water, and pressing them hard, they in a few hours burst out into flame. This composition has been employed for imitating earthquakes.
*Crocus martis*. By deflagrating with iron.
*Crocus martis aperiens*. By calcining the crocus martis in the fire till it assumes a red appearance.
*Crocus martis astringens*. By pushing the heat still further. }
Tin. A dark-coloured mass, resembling antimony. By fusion.
Mercury. { *Ethiops mineral*. By heating flowers of sulphur, and pouring the mercury upon it, and stirring it well. Its natural ore is called *cinnabar*.
*Factitious cinnabar*. By applying the mercury and sulphur to each other in their pure state, and subliming.
*Cinnabar of antimony*. By subliming corrosive sublimate and crude antimony ; or the residuum, after distilling butter of antimony. }
}

SEMIMETALS.

SEMIMETALS.
- BISMUTH. A faint greyiſh maſs, reſembling antimony. By fuſion. If in its metalline ſtate, the ſulphur ſeparates in the cold ; but not ſo if the calx has been employed.
- ANTIMONY. *Crude antimony.* By fuſion.
- ZINC*. A very brittle, dark-coloured, ſhining ſubſtance. With ſome difficulty, by keeping it long in a moderate fire, and covering it ſeveral times with ſulphur, and keeping it conſtantly ſtirred.
- ARSENIC.
  - *Yellow arſenic.* By fuſing it with $\frac{1}{10}$th its weight of ſulphur.
  - *Red arſenic.* By ditto with $\frac{1}{5}$th its weight of ſulphur.
  - *Ruby of ſulphur,* or arſenic, or golden ſulphur. By ſubliming when the proportions are equal.
  - *Orpiment.* A natural production ; not perfectly imitable by art ; compoſed of ſulphur and arſenic. Much uſed as a yellow paint.
- NICKEL. A compound ; compact and hard as lead ; of a bright metallic appearance ; internally yellow. By fuſion.

OILS : Expreſſed, Eſſential, and Foſſile, as above.

WATER. *Gas ſylveſtre.* By receiving the fumes of burning ſulphur in water. This ought rather to be called a union of the volatile vitriolic acid with water.

### *ALCOHOL may be combined with the following Subſtances,* viz.

ACIDS : Vitriolic, Nitrous, Muriatic, Vegetable, and of Borax, as above.

ALKALI* : Volatile, as above.

METALLIC calces, in ſome particular caſes.

OILS : Expreſſed, Eſſential, Empyreumatic, and Foſſile, as above.

WATER. By ſolution.

### *GOLD may be combined with the following Subſtances,* viz.

ACIDS : Vitriolic*, Nitrous*, and Muriatic*. In the circumſtances and with the phenomena above deſcribed.

ALKALIES : Fixed*, and Volatile*, as above.

METALS.
- SILVER. By fuſion. And the ſame is to be underſtood of all the combinations of metals, unleſs particularly ſpecified.
- PLATINA. Ductile, and of a duſky colour. This has been employed to debaſe gold, as it is of the ſame ſpecific gravity, and is not diſcoverable by the uſual teſts for diſcovering the purity of gold.
- LEAD. A very brittle maſs. Gold is rendered pale by the leaſt admixture with this.
- TIN. A brittle maſs when the tin is added in conſiderable quantity ; but the former accounts of this have been exaggerated.
- COPPER. Paler and harder than pure gold. This mixture is uſed in all our coins, the copper being called the *alloy*.
- IRON. Silver-coloured, hard and brittle ; very eaſily fuſed.
- MERCURY. Soft like a paſte called an *amalgamum.* By ſolution ; it being in this caſe called *amalgamation* ; and the ſame is to be underſtood of the ſolution of any other metal in quickſilver.

SEMIMETALS.
- ZINC. A bright and whitiſh compound, admitting of a fine poliſh, and not ſubject to tarniſh ; for which qualities it has been propoſed as proper for analyſing ſpecula for teleſcopes.
- ARSENIC. Brittle ; and the gold is thus rendered a little volatile.
- ANTIMONY. A fine powder for ſtaining glaſs of a red colour. By calcination.
- BISMUTH*. A brittle whitiſh regulus ; volatile in the fire.
- COBALT.
- NICKEL. White and brittle.

### *SILVER may be combined with the following Subſtances,* viz.

ACIDS : Vitriolic*, Nitrous*, Muriatic*, Vegetable*, and Acid of Ants*, as above.

ALKALIES : Fixed* and Volatile*, as above.

CRYSTALLINE EARTHS and other vitreous matters. A fine yellow opake glaſs. The fineſt yellow paint for porcelain is procured from glaſs mixed with ſilver.

METALS.
- GOLD, as above.
- PLATINA. Pretty pure and malleable. Difficult of fuſion ; and in part ſeparates when cold.
- LEAD. Very brittle.
- TIN. Extremely brittle, as much ſo as glaſs.
- COPPER. Harder than ſilver alone. Uſed in ſmall proportions as alloy in coins.
- IRON. A hard whitiſh compound.
- MERCURY*. By amalgamation with ſilver-leaf, or calx of ſilver precipitated by copper, but not by ſalts. This is uſed for ſilverizing on other metals, in the ſame way as the amalgamum of gold.

SEMIMETALS.
- ZINC. Hard, ſomewhat malleable, and of a white colour.
- ANTIMONY. A brittle maſs.
- BISMUTH. A white ſemi-malleable body.
- ARSENIC. Brittle ; the ſilver being rendered in part volatile.
- COBALT.

SULPHUR, as above.

### *LEAD may be combined with the following Subſtances,* viz.

ACIDS : Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Ants, as above.

ALKALIES : Fixed and Volatile, as above.

CRYSTALLINE EARTHS. A thin glaſs. By fuſion in a moderate heat.

METALS.
- GOLD and Silver, as above.
- PLATINA. Of a leafy or fibrous texture, and purpliſh or blue colour when expoſed to the air. If a large proportion of platina is uſed, it ſeparates in the cold.
- TIN. A little harder than either of the metals, and eaſily fuſed : hence it is uſed as a ſolder for lead ; and it forms the principal ingredients of pewter. If the fire is long continued, the tin floats on the ſurface.
- Copper*. Brittle and granulated, like tempered iron or ſteel when broke. By throwing pieces of copper into melted lead. The union here is very ſlight.
- IRON*. An opaque browniſh glaſs. By a great degree of heat if the iron has been previouſly reduced to the ſtate of a calx ; but never in its metallic ſtate.
- MERCURY*. By amalgamation. Effected only in a melting heat, unleſs ſome biſmuth has been previouſly united with the mercury.

SEMIMETALS.
- ZINC. Hard and brittle. By pouring zinc on melted lead. If the zinc is firſt melted, and the lead injected upon it, it then deflagrates.
- ANTIMONY*.
- BISMUTH. A grey-coloured ſemi-malleable body, eaſily fuſed ; and thence uſed as a ſolder for lead or tin.
- ARSENIC.
  - A grey-coloured brittle maſs, eaſily fuſed, and extremely volatile.
  - A hyacinth-coloured glaſs. By fuſion in a conſiderable heat. This glaſs is eaſily fuſed ; and is a much more powerful flux than pure glaſs of lead.
- COBALT. The nature of this compouud is not known.
- NICKEL. A brittle metallic body.

OILS : Expreſſed* and Eſſential, as above.
SULPHUR, as above.

*TIN may be combined with the following Subſtances,* viz.

ACIDS : Vitriolic*, Nitrous*, Muriatic, Vegetable*, of Urine, as above.
ALKALIES : Fixed and Volatile, as above.
CRYSTALLINE EARTHS or other vitreous matters. An opaque white vitreous maſs, which forms the baſis of white enamels.

METALS.
- GOLD, Silver, and Lead, as above.
- PLATINA. A coarſe hard metal which tarniſhes in the air.
- COPPER. A brittle maſs. When the copper is in ſmall proportions, it is firmer and harder than pure tin. This, in right proportions with a little zinc, forms bell-metal.
- IRON. A white brittle compound. By heating filings of iron red-hot, and pouring melted tin upon them. A metal reſembling the fineſt ſilver is made of iron, tin, and a certain proportion of arſenic.
- MERCURY. This amalgamum forms foils for mirrors ; and forms the yellow pigment called *aurum moſaicum.* By being ſublimed with ſulphur and ſal ammoniac.

SEMIMETALS.
- ZINC. Hard and brittle. When the zinc is in ſmall proportions, it forms a very fine kind of pewter.
- ANTIMONY* *Regulus veneris.* By elective attraction from copper and crude antimony
- BISMUTH. Bright, hard, and ſonorous, when a ſmall proportion of biſmuth is uſed. This is very eaſily fuſed, and employed as a ſolder.
- ARSENIC. A ſubſtance in external appearance reſembling zinc.
- COBALT. By fuſion.
- NICKEL. A brittle metallic maſs.

OIL : Expreſſed*, as above.
SULPHUR, as above.

*COPPER may be combined with the following Subſtances,* viz.

ACIDS : Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.
ALKALIES : Fixed, and Volatile, as above.

METALS.
- GOLD, Silver, Lead*, and Tin, as above.
- PLATINA. A white and hard compound, which does not tarniſh ſo ſoon as pure copper, and admits of a fine poliſh.
- IRON. Harder and paler than copper. Eaſily fuſed.
- MERCURY*. A curious amalgam. Soft at firſt, but afterwards brittle. By triturating mercury with verdigris, common ſalt, vinegar, and water.

SE IMETALS.
- ZINC.
  - *Braſs.* Commonly made by cementation with calamine. The larger the proportion of zinc, the paler, harder, and more brittle is the braſs.
  - *Prince's metal, pinchbeck,* and other metals reſembling gold. By employing zinc in ſubſtance in ſmall proportions. The beſt pinchbeck about 1-4th of zinc.
  - *Spelter.* A native ſubſtance, found in Cornwall, conſiſting of zinc and copper, and uſed as a ſolder.
- ANTIMONY. By fuſion.
- BISMUTH. A paliſh brittle maſs. Somewhat reſembling ſilver.
- ARSENIC. *White copper.* By pouring arſenic, fuſed with nitre, upon copper in fuſion. If too large a proportion of arſenic is uſed, it makes the compound black and apt to tarniſh.
- COBALT. White and brittle.
- NICKEL. White and brittle, and apt to tarniſh.

OILS : Eſſential, as above.
SULPHUR, as above.

*IRON*

*IRON may be combined with the following Substances,* viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.
ALKALIES: Fixed*, and Volatile, as above.
VITRESCENT EARTHS. A transparent glass. In general blackish; but sometimes yellow, green, or blue. The colour is influenced by the degree of heat as well as nature of the ingredients.
METALS. { GOLD, Silver*, Lead*, Tin, and Copper, as above.
PLATINA. With cast iron it forms a compound remarkably hard, somewhat ductile, and susceptible of a fine polish.
SEMIMETALS. { ZINC. A white substance resembling silver.
ANTIMONY. The magnetic quality of the iron is totally destroyed in this compound.
BISMUTH. In a strong heat, this emitteth flames.
ARSENIC. A whitish, hard, and brittle compound. By fusing with soap or tartar. A metal resembling fine steel is made by fusing cast iron with a little arsenic and glass.
COBALT. A compound remarkably ductile. By fusion in a moderate heat.
NICKEL. A brittle mass.
SULPHUR, as above.

*MERCURY may be combined with the following Substances,* viz.

ACIDS: Vitriolic, Nitrious, Muriatic, Vegetable*, of Urine, as above.
ALKALI: Fixed*, as above.
METALS. { GOLD, Silver*, Lead*, Tin, and Copper, as above.
PLATINA. The compound resulting from this mixture is not known.
SEMIMETALS. { ZINC. An amalgam. Soft or hard, according to the proportions employed.
ANTIMONY. By melting the regulus, and pouring it upon boiling mercury. By frequently distilling from this amalgam, the mercury is rendered much more pure, and then is called *animated mercury*.
BISMUTH. A silverizing for iron. By putting this amalgam upon iron, and evaporating the mercury. It has much the appearance of silver.
COBALT. By mixing first with nickel, and then adding mercury.
SULPHUR, as above.

*ZINC may be combined with the following Substances,* viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.
METALS. { GOLD, Silver, Lead, Tin, Copper, and Iron, as above.
PLATINA A hard substance.
MERCURY, as above.
SEMIMETALS. { ANTIMONY. This mixture is applied to no particular use.
ARSENIC. A black and friable mass.
COBALT. The particular nature and properties of this mixt is not known.
OIL: Expressed*, as above.
SULPHUR*, as above.

*ANTIMONY may be combined with the following Substances,* viz.

ACIDS: Vitriolic*, Nitrous, Vegetable*, and Urinous. With the phenomena, and by the means above described.
ALKALIES: Fixed and Volatile, as above.
VITREOUS EARTHS. A thin penetrating glass; which is a powerful flux of metals.
METALS. { GOLD, Silver, Lead, Tin*, Copper, and Iron, as above.
PTATINA. A hard mass.
MERCURY, and Zinc, as above.
SEMIMETALS. { BISMUTH. A mass resembling regulus of Antimony.
ARSENIC. The nature and qualities of this mixt are not known.
COBALT. Nature unknown.
NICKEL. Ditto.
SULPHUR, as above.

*BISMUTH may be combined with the following Substances,* viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, and Urinous; with the phenomena, &c. above described.
ALKALIES: Fixed*, and Volatile*, as above.
VITREOUS MATTERS. A yellow glass. The ore of Bismuth affords with these a blue glass; but this is probably owing to some mixture of Cobalt with it.
METALS. { GOLD, Silver, Lead, Tin, Copper, and Iron, as above.
PLATINA. This mixture changes its colour much on being exposed to the air.
MERCURY, as above.
SEMIMETALS. { ANTIMONY, as above.
ARSENIC. Nature not known
COBALT*. By mixing first with with nickel or regulus of antimony, and then adding cobalt; but it cannot be united by itself.
NICKEL. This mixt is not known.
SULPHUR, as above.

*ARSENIC may be combined with the following Substances,* viz.

ACIDS: Vitriolic, Muriatic*, Vegetable*, and Urinous; with the phenomena, &c. abovementioned.

ALKALIES.

ALKALIES : Fixed, and Volatile ; with the phenomena, and by the means mentioned above.
VITREOUS MATTERS. A glass which greatly promotes the fusion of other substances. The arsenic must first be prepared by dissolving and precipitating from alkalies.
METALS: { GOLD, Silver, Lead, Tin, Copper, and Iron, as above. PLATINA.
SEMIMETALS. { ZINC, Antimony, and Bismuth, as above. COBALT. NICKEL. The phenomena attending these mixtures have not been as yet particularly observed.
SULPHUR, as above.

*PLATINA may be combined with the following Substances,* viz.

ACIDS : Muriatic*; with the phenomena, *&c.* mentioned above.
ALKALI : Volatile, as above.
METALS : GOLD, Silver, Mercury, Tin, Copper, and Iron, as above.
SEMIMETALS. { ZINC, Bismuth, and Arsenic, as above. COBALT. NICKEL. The phenomena attending these mixtures not yet observed.

*COBALT may be combined with the following Substances,* viz.

ACIDS : Vitriolic, Nitrous, Muriatic, and Urinous ; with the phenomena, *&c.* as above described.
ALKALI : Volatile, as above.
EARTHS. CALX of FLINT. { *Saffre.* By mixing calcined cobalt with calx of flint, and moistening them with water, and pressing them close in wooden tubs. *Smalt.* By vitrifying these with the addition of a little potash.
METALS : GOLD, Silver, Platina, Mercury*, Lead, Tin, Copper, and Iron, as above.
SEMIMETALS. { ZINC, Antimony, Bismuth*, and Arsenic, as above. NICKEL. The properties of this compound not known.

*NICKEL may be combined with the following Substances,* viz.

ACIDS: Nitrous, and Muriatic ; with the phenomena, *&c.* as mentioned above.
ALKALI : Volatile, as above.
METALS : Gold, Platina, Lead, Tin, Copper, and Iron, as above.
SEMIMETALS : Antimony, Bismuth, Arsenic, and Cobalt, as above.
SULPHUR, as above.

*ABSORBENT EARTHS may be combined with the following Substances,* viz.

ACIDS : Vitriolic, Nitrous, Muriatic, and Vegetable ; with the phenomena, and by the assistances abovementioned.
ALKALIES: Fixed as above.
EARTHS. { CRYSTALINE. By this mixture they are both much easier melted into glass than by themselves, but not without the addition of some alkali. ARGILLACEOUS. This mixture easily runs into a glass without any addition.
WATER. *Lime-water.* By solution. It is sometimes found flowing out of the earth in springs ; and as it always quits the water when exposed to the air, it is there deposed on the banks of the streams, forming the stony incrustations called *petrifications* : And filtering through the pores of the earth, and dropping through the roofs of subterraneous caves, it forms the curious incrustations found hanging from the roof of such places ; sometimes assuming forms stupenduously magnificent.
AIR. FIXT. *Lime-stone.* It is from the quality that quick-lime has of absorbing its air, again with it resuming its stony consistence, that it is fitted for a cement in building ; and the great hardness of the cements in old buildings is owing to the air being more perfectly united with these than in newer works.

*CRYSTALLINE or VITRESCENT EARTHS may be combined with the following Substances,* viz.

ACIDS : Vitriolic*, and Nitrous*; with the phenomena, *&c.* as abovementioned.
ALKALI : Fixed, as above.
ABSORBENT EARTHS : as above.
ARGILLACEOUS EARTHS. A mass running into glass in a moderate heat.
METALS : Lead, Tin, Copper, and Iron, as above.
WATER. Although this is not soluble in water by any operation that we are acquainted with ; yet, from its crystalline form, it is probable that it has been once suspended ; and certainly it is so at this day in those petrifying springs whose incrustations are of the crystalline sort.
SEMIMETALS : Antimony, Bismuth, Arsenic, and Cobalt, as above.

*ARGILLACEOUS EARTH may be combined with* Absorbent and Crystalline Earths, as above. With water it only unites into a paste of a mechanical nature.

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Some late experiments of Dr Priestley, have shown, that though nitrous acid is produced from the decomposition of dephlogisticated and phlogisticated air, by taking the electric spark in the mixture, it is likewise produced by the more rapid decomposition of combustion, when inflammable air is made use of instead of the phlogisticated kind. In this case, though phlogisticated air should happen to exist in the mixture, it is not in the least affected by the process, but remains after the combustion of the others, just as it was; nay, the Doctor observes, that by the addition of phlogisticated air, the quantity of nitrous acid produced is so far from being augmented, that it is much diminished. The acid in these processes always appears to be extremely volatile, insomuch that some part of it constantly escapes. No liquor at all was condensed when the explosions were made in quick succession, even though the vessel never became hotter than the hand. In another process, the atmospheric air was perfectly excluded, while the purest dephlogisticated air was produced from one of the materials employed, viz. precipitate *per se*. In this experiment he found, that a considerable quantity of fixed air was produced, and that the water became acid by the absorption of it. He concludes, therefore, on the whole, that a mixture of dephlogisticated and inflammable air always produces an acid by combustion; but that, when they are in their nascent state, the aerial acid is generated; when both are completely formed previous to the experiment, the nitrous acid appears.

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M. Pelletier has now discovered a method of uniting phosphorus, without any decomposition, with all the metals, though he cautions against the danger with which the process is attended. Gold is phosphorated by mixing half an ounce of its calx with an ounce of phosphoric glass and about a grain of powdered charcoal; the whole is then put into a crucible, the composition covered with a little powdered charcoal, and a degree of heat sufficient to fuse the gold applied. A great many phosphoric vapours arise, but part are detained, and unite with the gold which is left at the bottom of the crucible. The metal by this operation loses its colour, becomes whitish, breaks under the hammer, and has a crystalline appearance. By continuing the fire a long time the phosphorus would be entirely dissipated. The quantity of phosphoric glass and charcoal just mentioned is sufficient to phosphorate a whole ounce of platina. By an hour's calcination in a crucible, the metal is converted into a blackish mass resembling silver, weighing upwards of an ounce, and of which the lower part consists of cubical crystals. Notwithstanding this change, however, the quantity of phosphorus united with the platina is very inconsiderable; for from 12 ounces of the metal, and as much phosphoric glass, only 12 ounces and five grains of the phosphorated metallic mass was obtained. It was very brittle, but of considerable hardness; was not attracted by the magnet, and by exposure to a strong fire parted with the phosphorus it had been combined with. He observes, that all the metals lose their malleability by combination with phosphorus, excepting tin and lead; and the residuum of the matter which has once phosphorated a metal, will serve again for the same purpose.

The

The salt formed by a combination of the phosphoric acid with mineral alkali is found to be an useful purgative, and as such is now brought into practice.

Messrs Struve and Marquart are said to have discovered, that the gastric juice of animals is composed of the phosphoric acid and volatile alkali; and Mr Struve has composed a liquid from these two ingredients which acts in a similar manner on alimentary matters.

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The acid procurable from this substance by means of the nitrous, resembles that of tartar, in being capable of supersaturating the vegetable alkali, and forming with it an acid salt resembling crude tartar. This is found naturally existing in sorrel and some other plants. There is, however, another acid obtained from sugar along with an empyreumatic oil, by dry distillation, which has been purified and examined by Mr Schrikel. Eight ounces and four scruples of liquid were obtained in this manner from 16 of fine sugar. About six drachms of water came over first; after which the acid passed in white vapours, which condensed in unctuous striæ on the sides of the receiver. It had a pungent and agreeable smell, and tasted empyreumatic By repeated distillations from pure clay, its smell became mild, and it acquired an apparent increase of acidity. With vegetable alkali, it formed a salt tasting like that of Sylvius, and shooting into needle-like crystals, soluble with difficulty in cold water, but not at all in spirit of wine. It did not deliquate in the air; but decrepitated in the fire, and did not melt on hot coals. With the mineral alkali yellow crystals were formed resembling Rochelle salt in taste, easily soluble in water, and not deliquating in the air. Volatile alkali gave a sharp saline liquor, which could not be crystallized, but left a saline mass on evaporation; and a similar saline mass was produced by uniting it with calcareous earth. Magnesia and earth of alum formed gummy compounds. When concentrated, it dissolved the calx of gold, and even gold-leaf; but had no effect on silver, mercury, or their calces With minium, it gave a yellow solution, which shot into oblong white crystals of an astringent taste. A blood-red solution, which shot into green crystals was obtained from iron. Copper was dissolved into a green liquid, which did not crystallize. Regulus of antimony was also dissolved, and the solution was of a greenish colour. Zinc was partly dissolved into a green liquor, and partly corroded. The precipitates were remarkable. The crystals of iron gave a green precipitate with alkalies, a black or dark blue one with Prussian alkali, and a white one with marine acid. Solution of regulus let fall a yellow precipitate with fixed alkali; with volatile alkali, a powder soluble again in the precipitant; vitriolic and marine acids, and an infusion of galls, threw down a white powder, but no precipitate ensued on adding nitrous acid Solution of zinc gave a white precipitate with infusion of galls, alkalies of all kinds whether fixed, volatile, or phlogisticated, as well as by the vitriolic acid. Tin was partially dissolved, and the solution precipitated by alkalies, and an infusion of galls, but not by any of the mineral acids. Lead was precipitated of a white colour by vitriolic and marine acids, and of a grey colour by infusion of galls.

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Though the acid of tartar has been commonly supposed a product of the vinous fermentation, yet late experiments have shown that this is not the case. It has been found not only in the juice of the grape, but in that of tamarinds, the berries of the *rhus coriaria*, and the leaves of the *rumex acetosa*. In these it is generally combined with the vegetable fixed alkali, or with calcareous earth. Hermbstadt has found it combined with calcareous earth in the juice of the roots of the *triticum repens*, the *leontodon-taraxacum*, and *China bark*. By the assistance of nitrous acid he obtained it also from the juice of grapes, mulberries, apples, pears, oranges, strawberries, and plums; also from honey, sugar, gum arabic, manna, spirit of wine, beech-wood, and the root of black hellebore. In these cases, where the nitrous acid is made use of, however, it may justly be supposed that the acid of tartar is partly at least produced from it. In Scheele's process for procuring the pure acid of tartar by means of calcareous earth, it is advisable to make use of quicklime rather than chalk, as by this double the quantity of tartar will be decomposed. An hundred parts of pure tartar contain about 23 of vegetable alkali, 43 parts of acid employed to saturate that alkali, and 34 of superabundant acid. By using oyster-shells well prepared by boiling and powdering, the crystals of the acid may be obtained very white and pure. Some chemists have imagined that the vegetable alkali does not exist ready formed in tartar, but that it is produced by fire or mineral acids. In proof of this M. Machi offers the following experiments. On an ounce of cream of tartar were poured 10 ounces of boiling water, and the mixture allowed to remain in a jar covered with paper and parchment in which a small hole was made with a pin. At the end of three months it was considerably diminished; and contained a quantity of thick, tough, yellow, mucilaginous matter, which neither effervesced with acids nor alkalies, and, when burnt, the ashes were found to contain only a very small quantity of alkali. The experiment was repeated by Mr Corvinus with some variation. He kept a solution of cream of tartar in a heat between 10° and 30° of Reaumur's scale; removing the saline pellicles which formed on the surface as fast as they appeared, and redissolving them in water. By continuing the digestion for several months, the liquor became at last evidently alkaline: and he thus obtained 216 grains of a brown alkali from two ounces of cream of tartar. Mr Berthollet exposed for nine months, to the heat of his laboratory, a solution of two ounces of cream of tartar in eight ounces of water; taking care to replace the water which evaporated, but without removing the crusts which formed upon the surface. At the end of this time he found that the liquor was no longer acid, but began to turn the syrup of violets green. In 18 months it became strongly alkaline; and left, when evaporated, an oily residuum which effervesced with acids, and weighed 468 grains. On treating in the same manner a solution of terra foliata tartari, the liquor began to change the syrup of violets green in two months, and in four the decomposition seemed to be complete. At the end of a year he filtered and evaporated the liquor to dryness, by which process he obtained 432 grains of fixed alkali. The same quantity of terra foliata tartari decomposed immediately by distillation, yielded only 36 grains more of alkali. Solution of salt of wood-sorrel suffered no decomposition by a similar treatment for two years. The latter he observed to be a much more powerful antisceptic than tartar; for which reason it seems to resist decomposition in a proportionable degree. He supposes oil to be the principal cause of the destruction of these acids; and the obvious deficiency of oil in the saccharine acid, in comparison with tartar, seems to be the cause of the want of capacity in it to undergo the decomposition just mentioned. A remarkable circumstance attends this spontaneous decomposition, viz. that no air is either absorbed or emitted during the whole process. It is also worth notice, that in combining acid of tartar with fixed alkalies, the salt supersaturated with acid or cream of tartar is always formed in preference to the other called *soluble tartar*. Thus if to a saturated solution of alkali with cream of tartar we add another of pure tartareous acid, a white spongy matter will be precipitated to the bottom; which, on examination, is found to be a true tartar. Any other acid added to the solution of tartarised tartar will in like manner produce a precipitation of tartar, by engaging a part of the alkali with which it was combined; and if the acid of tartar be added to a solution of any neutral salt containing the vegetable fixed alkali, as vitriolated tartar, salt of Sylvius, and nitre, a similar precipitation of tartar will ensue. Hence the acid of tartar may be employed as a test to discover the presence of the vegetable fixed alkali, and to distinguish it from the mineral, which has not that effect. Bergman indeed observes, that Rochelle salt will do the same thing; but it must be remembered that this is prepared with crude tartar, which contains a portion of vegetable alkali, and not with the pure acid.

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*The following is a list of the Vegetables from which the industry of the modern chemists has procured different acids, with the names of the discoverers.*

1 *Agave Americana.* The juice exsuding from the calyx of this plant yields acid of tartar and apples. Mr *Hoffman of Weimar.*

2 *Aloes.* Acid of sugar and apples. Mr *Scheele.*

3 *Apples.* A peculiar acid called by the name of the fruit. By nitrous acid that of tartar is procured. Mr *Scheele* and Mr *Hermbstadt.*

4 *Barberry.* Acid of apples, and of tartar. By treatment with nitrous acid it yields acid of sugar. *Scheele* and *Hermbstadt* —Hoffman denies that it contains any native acid of tartar. By treating it with spirit of wine and manganese he obtained an ether.

5 *Bilberry* (*Vaccinium myrtillus*). Equal parts of the acids of citrons and apples. *Scheele.*

6 *Bramble* (*Rubus chamæmorus*). The same with the foregoing. *Scheele.*

7 *Camphor.* A peculiar kind of crystallizable acid. *M. Kosegarten.*

8 *Cherries,* Equal parts of acids of citrons and apples. Saccharine acid by treatment with spirit of nitre. *Scheele, Hermbstadt,* and *Westrumb.*—Hermbstadt says that he found acid of tartar also.

9 *Citrons* and *lemons.* A particular kind of crystallizable acid. *Scheele*

10 *Coffee.* The infusion evaporated and treated with spirit of nitre. Acids of sugar and apples. *Scheele.*

11 *Corks.* A yellow acid by repeated abstractions of spirit of nitre. With some of the alkalies and earths this acid forms crystallizable salts which do not deliquate, though others do. That with fixed vegetable alkali forms needle-like crystals, soluble in water, vitriolic, nitrous, or marine acids, but not in vinegar or spirit of wine. Like the saccharine acid it has a strong affinity to calcareous earth, which it separates from lime-water, and forms a greyish saline powder, soluble in marine acid, but not in water, nor even in its own acid. It exhibits some appearances with metals, which deserve farther examination. *Brugnatelli.*

12 *Cranberry.* (*Vaccinium oxycoccos*). Acid of citrons. *Scheele.*

13 *Currants, red* and *white.* Acids of citrons and apples. *Westrumb.* Hermbstadt says that they contain acid of tartar.

14 *Elder berries.* Acid of apples. *Scheele.*

15 *Galls.* A peculiar kind of acid. *Scheele*—Mr Kier observes, that from other astringent matters, especially those used in dyeing, it is probable that similar acids might be obtained, Mr Morveau has obtained from galls a resin which he supposes to be their acidifiable base; and which, along with pure air, forms the acid of galls. When purified, this acid is said to make a fine and durable ink.

16 *Geranium acidum.* Small acid crystals *Cartheuser.* Said by Hermbstadt to be the acid of sugar.

17 *Gooseberries.* Acid of apples. *Scheele.*—Hermbstadt says that they contain the acid of tartar also.

18 *Grapes.* Their juice well known to contain the acid of tartar partially combined with fixed alkali.

19 *Grass-roots.* Saline crystals from the extract of the juice after three months standing. These were soluble in water, and gave an earthy precipitate on mixture with fixed alkali. On abstracting the nitrous acid from them, and adding a solution of calcareous earth in vinegar, a precipitate fell, which was found to consist of acid of tartar saturated with lime. *Hermbstadt.*

20 *Gum Arabic.* Acid of sugar and apples. *Scheele.*

21 *Gum tragacanth.* Acids of sugar of milk, apples, and sugar.

22 *Haw* (*Cratægus aria*). Equal parts of acids of citrons and apples.

23 *Honey.* An acid liquor by distillation; and with spirit of nitre, the acid of sugar. The distilled acid has been said to dissolve gold.

24 *Lemons.* An acid the same with that of citrons.

25 *Leontodon taraxacum.* Acid of tartar by treatment with spirit of nitre.

26 *Manna.* Acid of sugar by treatment with spirit of nitre.

27 *Mulberries.* Acid of tartar. *Hermbstadt.* A crystallizable acid salt by evaporating the juice. *Angelus Sala.*

28 *Oil of olives.* A salt which sublimed and crystallized, by repeated and copious abstractions of the nitrous acid. *Westrumb.*

29 *Peruvian bark.* Acid of apples and sugar, by treating the extract with nitrous acid. *Scheele.*

30 *Prunus spinosa et domestica.* Acid of apples. *Scheele.*

31 *Prunus padus.* Acid of citrons. *Scheele.*

32 *Poppy.* Acids of sugar and apples, by treating the juice with nitrous acid. *Scheele.*

33 *Raspberries.* Acids of apples and citrons. *Scheele.* Acid of tartar by saturating the juice with chalk, and then separating the earthy basis by means of vitriolic acid. *Hermbstadt.*

34 *Rhapontic.* Acid of tartar by crystallizing the juice; of sugar by treating it with nitrous acid. *Bindheim.*

35 *Rhubarb.* Acids of sugar and apples by treating the infusion with nitrous acid. If a pound of Indian rhubarb be infused in hot water, a powder subsides, which by washing becomes white, weighing then about nine drachms, and is found to consist of calcareous earth united with the acid of sugar. *Scheele.*

36 *Ribes cynosbati.* Acid of citrons or lemons. *Scheele*

37 *Salep.* Acids of sugar and apples by treatment with nitrous acid. *Scheele.*

38 *Service* (*Sorbus aucuparia*). Acid of apples. *Scheele.*

39 *Solanum dulcamara.* Acid of citrons *Scheele.*

40 *Sorrel* (*Rumex acetosa*). Crystals of tartar by evaporating and crystallizing the juice; and pure acid of tartar by saturating the acid with chalk, and then expelling it by means of the vitriolic. *Hermbstadt.* Other chemists, however, have certainly found it to contain the acid of sugar partly neutralized with alkali, and which is capable of being crystallized. This is generally known under the name of *salt of wood-sorrel,* and is manufactured in considerable quantities in Thuringia, Suabia, Switzerland, and the Hartz. It is prepared from this plant as well as the *oxalis acetosella.* The plants are bruised in stone or wooden mortars; the juice is squeezed through linen; and when cleared by settling, is to be boiled to a proper consistence, and clarified with the whites of eggs, or with blood. It is to be strained whilst hot, and then kept in a cold cellar. In a few weeks crystals will be formed, from which the remaining liquor must be poured off, and by further evaporation will yield more salt. Savary obtained only two ounces, and a half of salt from 25 pounds of the juice.

41 *Strawberries.* Equal parts of the acids of apples and citrons. *Scheele.*

42 *Sugar.* See the article.

43 *Sumach* (*Rhus coriaria*). Crystals of tartar. Professor *Tromsdorf* and *Son.*

44 *Tamarinds.* Acid of tartar, tartar itself, with a mucilaginous and saccharine matter. *Westrumb.*

45 *Vaccinium vitis idæa.* Acid of citrons. *Scheele.*

46 *Wood and bark of the birch tree.* From 55 ounces of the wood were obtained 17 ounces of rectified acid, which when freed from an amber-coloured oil was to the specific gravity of water as 49 to 48, and of such strength that one ounce of it required 23 of lime-water for its saturation. *Chemists of Dijon.*—By allowing the acid distilled from the bark to remain at rest for three months, much of its oil was separated; by saturation with fixed alkali a dark-coloured neutral salt was obtained, which was purified by fusion and subsequent filtration and evaporation. On subjecting

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*York*, account of the aluminous ore found near that place, 660.

ZAFFRE, a calx of cobalt, deſcribed, 1294.

*Zinc* and iron, the only metals diſſolved by vitriolic acid, 337 Of their precipitation by one another, 347 Precipitates nickel, 358 Cannot precipitate cobalt, 361 Forms white vitriol with the vitriolic acid, 707 Combined with the nitrous acid, 767 With the marine acid, 820 Volatilized by it, ib. With acid of arſenic, 951 Cannot eaſily be combined with iron, 1162 Its combination with copper, 1154 The metal particularly treated of, 1240 Deflagrates violently in a ſtrong heat, ib. Sublimes into flowers, 1241 Dr Lewis's method of reducing them, 1242 Oil ſuppoſed to be obtained from them by Homberg, 1243 The miſtake diſcovered by Neumann, ib. Another oil by Mr Hellot, capable of diſſolving gold and ſilver leaf, 1244 Combination of zinc with other metals, 1245 Its combination with gold a proper material for ſpecula, 1246 Its deflagration with other metals, 1247 Cannot be united with ſulphur, 1248 Nitre alkalyſed by its flowers, 1249 Unites readily with platina, 1342.

CHEMNITZ,

CHEMNITZ, (Martin) a famous Lutheran divine, the disciple of Melancthon, was born at Britzen in Brandenburgh, in 1522. He was employed in several important negociations by the princes of the same communion; and died in 1589. His principal work is the Examen of the Council of Trent, in Latin.

CHEMOSH. See CHAMOS.

CHEMOSIS, a disease of the eyes, proceeding from an inflammation; wherein the white of the eye swells above the black, and overtops it to such a degree, that there appears a sort of gap between them. Others define it to be an elevation of the membrane which surrounds the eye, and is called the *white;* being an affection of the eye, like white-flesh.

CHENOPODIUM, GOOSE-FOOT, or *Wild Orach:* A genus of the digynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 20th order *Holoraceæ.* The calyx is pentaphyllous and pentagonal; no corolla; one seed lenticular, superior. There are 18 species, 13 of which are natives of Britain. The most remarkable are the following: 1. The bonus henricus, or common English mercury, found growing naturally in shady lanes in many places in Britain. It has large triangular, arrow-pointed, entire leaves; upright, thick, striated stalks garnished with triangular leaves, and terminated by close spikes of apetalous yellowish-green flowers in June and July, which are succeeded by ripe seeds in August. 2. The scoparia, belvidere, or annual mock-cypress, which is of a beautiful pyramidal form resembling a young cypress tree. 3. The botrys, or oak of Jerusalem. 4. The ambrosoides, or oak of Cappadocia. All these are very easily propagated from seeds; and will thrive best in a rich light earth. Most of the species have an aromatic smell. A species which grows near the Mediterranean is used by the Egyptians in sallads, on account of its saltish aromatic taste. From the same plant kelp is made in other countries.—The first species, or English mercury, was formerly used as spinach; but is now disused, as being greatly inferior to that herb. As an article of the materia medica, it is ranked among the emollient herbs, but rarely made use of in practice. The leaves are applied by the common people for healing slight wounds, cleansing old ulcers, and other like purposes. The roots are given to sheep that have a cough. Goats and sheep are not fond of the herb; cows, horses, and swine, refuse it.—The second species, or belvidere, is a plant much esteemed in China. The following are the properties attributed to it in the Chinese Herbal. After having said that it is about the end of March or beginning of April that the belvidere springs up from the earth; that its suckers or shoots rise to the height of eight or nine inches, in shape of a child's fist half shut; that it afterwards extends itself, and sends forth a number of branches loaded with leaves like those of flax; and that, as it grows, its branches arrange themselves naturally in the form of a beautiful pyramid; it adds, that its leaves, yet tender, abound with juice, and have a very agreeable taste; that it may be eaten as a sallad with vinegar, to which a little ginger has been added; that being prepared like other leguminous plants, and baked with meat, it gives it an agreeable and pleasing flavour: that, when in its full beauty, its leaves become hard and unfit for the table; but that nourishment is then found in its root, which serves as a resource in times of famine and scarcity. When the belvidere has attained to its natural size, the Chinese separate its principal stalk from the rest, and put it into a ley of ashes, which cleans and softens it, and frees it from all impurities of the bark. After this bath, it is exposed to the sun; and when dry it is baked and seasoned. With regard to the root, which has something of a violet-colour, they strip off the skin by filaments, which may be boiled and eaten: but what is particularly sought after, is the root itself; of which, when reduced to powder, they collect only what remains in the bottom of the vessel, and form it into small loaves that are baked by being held over the steam of boiling water. People of a delicate taste will scarcely be tempted to admit this dish at their tables; but is it not useful to point out to the poor peasants, that in cases of necessity, they may always have recourse, without danger, to this rustic food? In such cases, they will be indebted to the Chinese for having made the first trial, which, for the most part is, dangerous. The Chinese Herbal cites the example of four mountaineers, who having lived on nothing but the leaves, roots, and stalks, of the belvidere, with which their country abounded, had neverthelefs enjoyed perfect health to a very great age.



CHEPELIO, an island in the bay of Panama and province of Darien, in South America, situated about three leagues from the city of Panama, which it supplies with provisions. W. Long. 81. N. Lat. 9.

CHEPSTOW, a market town of Monmouthshire in England, seated on the river Wye near its mouth, in W. Long. 2. 40. N. Lat. 51. 40.

CHEQ, or CHERIF, the prince of Mecca, who is, as it were, high priest of the law, and sovereign pontiff of all the Mahometans of whatever sect or country they be. See CALIPH.

The grand signior, sophis, moguls, khans of Tartary, &c. send him yearly presents, especially tapestry to cover Mahomet's tomb withal, together with a sumptuous tent for himself, and vast sums of money to provide for all the pilgrims during the 17 days of their devotion.

CHERASCO, a strong and considerable town of Italy, in Piedmont, and capital of a territory of the same name, with a strong citadel, belonging to the king of Sardinia, where he retired in 1706, during the siege of Turin. It is seated at the confluence of the rivers Sturia and Tanaro, upon a mountain. E. Long. 7. 55. N. Lat. 44. 35.

CHERBURG, a sea-port town of France, in Normandy, with a harbour and Augustine abbey. It is remarkable for the sea-fight between the English and French fleets in 1692, when the latter were beat, and upwards of twenty of their men of war burnt near Cape la Hogue. The British landed here in August 1758, and took the town, with the ships in the bason, demolished the fortifications, and ruined the other works which had been long carried on for enlarging the harbour and rendering it more safe and convenient. Within these few years it has been attempted again to improve the harbour, and rebuild the works; but after considerable progress had been made, a great part of them suddenly gave way, and the enterprise it is is thought will not be again resumed. E. Long 1. 38. N. Lat. 49. 38.

CHEREM, among the Jews, is used to signify a species of annihilation. See ANNIHILATION.

The Hebrew word *cherem*, signifies properly to *destroy*, *exterminate*, *devote*, or *anathematise*.

CHEREM is likewise sometimes taken for that which is consecrated, vowed, or offered to the Lord, so that it may no longer be employed in common or profane uses. No devoted thing that a man shall devote unto the Lord, of all that he hath of man and beast, and of the field of his possession, should be sold or redeemed; every devoted thing is most holy to the Lord: none devoted, which shall be devoted of men, shall be redeemed, but shall surely be put to death. There are some who assert that the persons thus devoted were put to death; whereof Jephtha's daughter is a memorable example. Judges xi. 29. &c.

CHEREM is also used for a kind of excommunication in use among the Jews. See NIDDUI.

CHERESOUL, or CHAHRZUL, a town of Turkey in Asia, capital of Curdistan, and the seat of a beglerbeg. E. Long. 45. 15. N. Lat. 36. 0.

CHERILUS, of Samos, a Greek poet, flourished 479 years before Christ. He sung the victory gained by the Athenians over Xerxes, and was rewarded with a piece of gold for every verse. His poem had afterwards the honour of being rehearsed yearly with the works of Homer.

CHERLERIA, in botany: a genus of the trigynia order, belonging to the decandria class of plants; and in the natural method ranking under the 22d order, *Caryophylleæ*. The calyx is pentaphyllous; there are five nectaria, bifid, and petal-like; the antheræ alternately barren; the capsule is trilocular and three-valved.

CHERLESQUIOR, in Turkish affairs, denotes a lieutenant-general of the grand signior's armies.

Plate CXXXVIII.

CHERMES, in zoology, a genus of insects belonging to the order of insecta hemiptera. The rostrum is situated on the breast; the feelers are longer than the thorax; the four wings are deflected; the thorax is gibbous; and the feet are of the jumping kind. There are 17 species; and the trivial names are taken from the plants which they frequent, as the Chermes graminis, or grass-bug; the chermes ulmi, or elm-bug, &c. The chermes ficus, or fig-tree bug, one of the largest of the genus, is brown above and greenish beneath. The antennæ, likewise brown, are large, hairy, and one third longer than the thorax. The feet are yellowish; the wings large, twice the length of the abdomen. They are placed so as to form together an acute roof. The membrane of which they consist is thin and very transparent; but they have brown veins, strongly marked, especially towards the extremity. The rostrum of this chermes is black, and takes its rise from the lower part of the thorax, between the first and second pair of feet. It is an insect to be met with in great numbers upon the fig-tree. The larva has six feet. It is like the insect, when provided with wings. Its form is oblong, and its motion slow.

The chrysalis differs from it by two flat buds that spring from the thorax and inclose the wings, afterwards seen in the perfect insect. These chrysalids are frequently met with on plants; and the two plates of their thorax give them a broad uncouth appearance and a heavy look. When the little chrysalids are going to be metamorphosed, they remain motionless under some leaves which they fix themselves upon. Their skin then divides upon the head and thorax, and the perfect insect comes forth with his wings, leaving the spoil of his chrysalis open and rent anteriorly upon the leaf. These kind of sloughs are often found beneath the leaves of the fig-tree. The perfect insect is furnished with four wings, large in proportion to its body, veined, and placed in the form of a roof; and with them it flies. It has, moreover, the faculty of leaping pretty briskly, by means of its hinder-legs, which play like a spring. When it is attempted to catch the chermes, it makes its escape rather by leaping than flying. Some of those insects have a manœuvre worthy of notice. Several species are provided at the extremity of their body with a small sharp-pointed implement, but which lies concealed, and that they draw out in order to deposit their eggs, by making a puncture in the plant that suits them. By this method the fir-tree chermes produces that enormous scaly protuberance that is to be found at the summit of the branches of that tree, and which is formed by the extravasation of the juices occasioned by the punctures. The young larvæ shelter themselves in cells contained in the tumor. The white down, under which the larva of the pine-chermes is found, seems to be produced much in the same manner. That of the box-tree chermes produces no tubercula like those; but its punctures make the leaves of that tree bend and grow hollow in the shape of a cap, which by the union of those inflected leaves produces at the extremity of the branches a kind of knobs, in which the larvæ of that insect find shelter. The box-chermes, as well as some others, has yet another peculiarity, which is, that the larva and its chrysalis eject at the anus a white sweet-tasted matter, that softens under the touch, and is not unlike manna. This substance is found in small white grains within the balls formed by the box-leaves, and a string of the same matter is often seen depending from the anus of the insect.



*CHERMES Mineral.* See KERMES.

CHERRY-ISLAND, an island in the northern ocean, lying between Norway and Greenland, in E. Long. 20. 5. N. Lat. 75. 0.

*CHERRY-Tree*, in botany. See PRUNUS.

CHERSO, an island in the gulph of Venice, with a town of the same name near Croatia, belonging to the Venetians. The air is good, but the soil stony; however, it abounds in wine, cattle, oil, and excellent honey. E. Long. 15. 5. N. Lat. 45. 8.

CHERSONESUS, among modern geographers, the same with a peninsula; or a continent almost encompassed round with the sea, only joining to the main land by a narrow neck or isthmus. The words is Greek, χερσονησος; of χερσος, *land*, and νησος, *island*; which signifies the same. In ancient geography, it was applied to several peninsulas; as the Chersonesus Aurea, Cimbrica, Taurica, and Thracia, now thought to be Malacca, Jutland, Crim Tartary, and Romania.

CHERT, PETROSILEX, *Lapis Corneus*, the *Hornstein* of the Germans; a species of stone classed by Cronstedt among the siliceous earths. It is of a coar-

ser

fer texture than the common flint, as well as softer; for which reasons it is not capable of such a fine polish. It is semitransparent at the edges, or when broken into very thin pieces. It is found of different colours, *viz.* white, whitish yellow, flesh-coloured, and greenish. According to Mr Kirwan, it runs in veins through rocks, from whence its name is derived; its specific gravity being from 2590 to 2700. In the fire it whitens and decrepitates like silex, but is generally fusible *per se*. Mineral alkali does not totally dissolve it in the dry way, but borax and microcosmic salt do so without effervescence. Its appearance is duller and less transparent than common flint. The reddish petrosilex, used in the count de Lauragais's porcelain manufactory, and there called *feld-spat*, contained 72 *per cent.* of silex, 22 of argill, and 6 of calcareous earth.

Cronstedt observes that there are not as yet any certain characters known by which the cherts and jaspers may be distinguished from one another, though they can easily be so by sight; the cherts appearing of a fine sparkling texture when broken; but the jasper being grained, dull, and opaque, and having the appearance of a dry clay. The chert is also found forming larger or smaller veins, or in nodules like kernels in rocks; whereas the jasper, on the contrary, sometimes constitutes the principal part of the highest and most extended mountains. The chert is likewise found plentifully in the neighbourhood of scaly limestone, as flints are in the strata of chalk.

The connection between these bodies is not yet discovered; but it is impossible to establish any essential difference between them, from the circumstance of flints and agates being generally found in single, loose, and irregular nodules, and hardly in rocks like the chert: for near Constantinople the agate stone runs in a vein across the rock, of the same hardness, and as fine and transparent, as those agates found in round nodules at Deux Ponts

CHERTZEY, a market town of Surrey in England, about seven miles west from Kingston upon Thames. W. Long. 30′. N. Lat. 51. 25.

CHERUB, (plural, CHERUBIM); a celestial spirit, which in the hierarchy is placed next to the seraphim. See HIERARCHY.

The term *cherub*, in Hebrew, is sometimes taken for a calf or ox. Ezekiel sets down the face of a cherub as synonymous to the face of an ox. The word *cherub*, in Syriac and Chaldee, signifies to *till* or *plow*, which is the proper work of oxen. Cherub also signifies *strong* and *powerful*. Grotius says, that the Cherubim were figures much like that of a calf. Bochart thinks likewise, that the cherubim were more like to the figure of an ox than to any thing besides; and Spencer is of the same opinion. Lastly, St John, in the Revelations, calls cherubim *beasts*. Josephus says the cherubim were extraordinary creatures of a figure unknown to mankind. Clemens of Alexandria believes, that the Egyptians imitated the cherubim of the Hebrews in the representations of their sphinxes and their hieroglyphical animals. All the several descriptions which the scripture gives us of cherubim differ from one another; but all agree in representing them as a figure composed of various creatures, as a man, an ox, an eagle, and a lion. Such were the cherubim described by Ezekiel. Those which Isaiah saw, and are called *seraphim* by him, had the figure of a man with six wings; with two whereof they covered their faces, with two more they covered their feet, and with the two others they flew. Those which Solomon placed in the temple of Jerusalem are supposed to have been nearly of the same form. Those which St John describes in the Revelations were all eyes before and behind, and had each six wings. The first was in the form of a lion, the second in that of a calf, the third of a man, and the fourth of an eagle. The figure of the cherubim was not always uniform, since they are differently described in the shapes of men, eagles, oxen, lions, and in a composition of all these figures put together. Moses likewise calls these symbolical or hieroglyphical representations, which were embroidered on the veils of the tabernacle, *cherubim* of costly work. Such were the symbolical figures which the Egyptians placed at the gates of their temples and the images of the generality of their gods, which were commonly nothing but statues composed of men and animals.



CHERVIL, in botany. See CHÆROPHYLLUM.

CHESAPEAK, in America, one of the largest bays in the known world. Its entrance is between Cape Charles and Cape Henry in Virginia, 12 miles wide; and it extends 270 miles to the northward, dividing Virginia and Maryland. Through this extent it is from 7 to 18 miles broad, and generally about 9 fathoms deep; affording many commodious harbours, and a safe and easy navigation. It receives the waters of the Susquehannah, Patomack, Rappahannock, York, and James rivers, which are all large and navigable.

CHESELDEN (William), an eminent anatomist and surgeon, was born at Burrow on the Hill, in the county of Leicester, England, descended from an ancient family in the county of Rutland, whose arms and pedigree are in Wright's "History of Rutland." He received the rudiments of his professional skill at Leicester; and married Deborah Knight, a citizen's daughter, by whom he had one daughter, Williamina Deborah. In 1713 he published his Anatomy of the Human Body, one volume, 8vo; and in 1723, A Treatise on the High Operation for the Stone. He was one of the earliest of his profession who contributed by his writings to raise it to its present eminence. In the beginning of 1736, he was thus honourably mentioned by Mr Pope: "As soon as I had sent my last letter, I received a most kind one from you, expressing great pain for my late illness at Mr Cheselden's. I conclude you was eased of that friendly apprehension in a few days after you had dispatched your's, for mine must have reached you then. I wondered a little at your quære, Who Cheselden was? It shows that the truest merit does not travel so far any way as on the wings of poetry: he is the most noted and most deserving man in the whole profession of chirurgery; and has saved the lives of thousands by his manner of cutting for the stone." He appears to have been on terms of the most intimate friendship with Mr Pope, who frequently in his Letters to Mr Richardson, talks of dining with Mr Cheselden, who then lived in or near Queen Square. In February 1737, Mr Cheselden was appointed surgeon to Chelsea hospital. As a governor of the Foundling Hospital

Cheshire || Chesnut.

spital, he sent a benefaction of 50 l. to that charity, May 7, 1751, inclosed in a paper with the following lines:

'Tis what the happy to th' unhappy owe;
For what man gives, the gods by him bestow. POPE.

He died at Bath, April 11, 1752, of a disorder arising from drinking ale after eating hot buns. Finding himself uneasy, he sent for a physician, who advised vomiting immediately; and if the advice had been taken, it was thought his life might have been saved. By his direction, he was buried at Chelsea.

CHESHIRE, a maritime county of England, bounded by Lancashire on the north; Shropshire and part of Flintshire, on the south; Derbyshire and Staffordshire, on the east and south-east; and Denbighshire and part of Flintshire, on the west and north-west. It extends in length about 44 miles, in breadth 25; and is supposed to contain 125,000 inhabitants. Both the air and soil in general are good. In many places of the country are peat-mosses, in which are often found trunks of fir-trees, sometimes several feet under ground, that are used by the inhabitants both for fuel and candles. Here also are many lakes and pools well stored with fish: besides the rivers Mersee, Weaver, and Dee, which last falls into a creek of the Irish sea near Chester. This county also abounds with wood: but what it is chiefly remarkable for, is its cheese, which has a peculiar flavour, generally thought not to be inferior to any in Europe; (see CHEESE). The principal towns are, Chester the capital, Cholmondely, Namptwitch, &c.

William the Conqueror erected this county into a palatinate, or county-palatine, in favour of his nephew Hugh Lupus, to whom he granted the same sovereignty and jurisdiction in it that he himself had in the rest of the island. By virtue of this grant, the town of Chester enjoyed sovereign jurisdiction within its own precincts; and that in so high a degree, that the earls held parliaments, consisting of their barons and tenants, which were not bound by the acts of the English parliament: but this exorbitant power of the palatinates was at last reduced by Henry VIII.; however, all cases and crimes, except those of error, foreign-plea, foreign-voucher, and high-treason, are still heard and determined within the shire. The earls were anciently superiors of the whole county, and all the landholders were mediately or immediately their vassals, and under the like sovereign allegiance to them as they were to the kings of England; but the earldom was united to the crown by Edward III. since which time, the eldest sons of kings of England have always been earls of Chester, as well as princes of Wales. Cheshire sends four members to parliament; two for the county, and two for the capital.

CHESNE (Andrew du), styled the father of French history, was born in 1584. He wrote, 1. A history of the popes. 2. An history of England. 3. An inquiry into the antiquities of the towns of France. 4. An history of the cardinals. 5. A bibliotheca of the authors who have written the history and topography of France, &c. He was crushed to death by a cart, in going from Paris to his country-house at Verriere, in 1640.

CHESNUT-TREE. See FAGUS.

Chess.

CHESS, an ingenious game performed with different pieces of wood, on a board divided into 64 squares or houses; in which chance has so small a share, that it may be doubted whether a person ever lost a game but by his own fault.

Each gamester has eight dignified pieces, *viz*. a king, a queen, two bishops, two knights, and two rooks, also eight pawns: all which, for distinction's sake, are painted of two different colours, as white and black.

As to their disposition on the board, the white king is to be placed on the fourth black house from the corner of the board, in the first and lower rank; and the black king is to be placed on the fourth white house on the opposite, or adversary's end of the board. The queens are to be placed next to the kings, on houses of their own colour. Next to the king and queen, on each hand, place the two bishops; next to them, the two knights; and last of all, on the corners of the board, the two rooks. As to the pawns, they are placed, without distinction, on the second rank of the house, one before each of the dignified pieces.

Having thus disposed the men, the onset is commonly begun by the pawns, which march straight forward in their own file, one house at a time, except the first move, when it can advance two houses, but never moves backwards: the manner of their taking the adversary's men is side-ways, in the next house forwards; where having captivated the enemy, they move forward as before. The rook goes forward or cross-ways through the whole file, and back again. The knight skips backward and forward to the next house, save one, of a different colour, with a sidling march, or a slope, and thus kills his enemies that fall in his way, or guards his friends that may be exposed on that side. The bishop walks always in the same colour of the field that he is placed in at first, forward and backward, aslope, or diagonally, as far as he lists. The queen's walk is more universal, as she takes all the steps of the before mentioned pieces, excepting that of the knight; and as to the king's motion, it is one house at a time, and that, either forward, backward, sloping, or side-ways.

As to the value of the different pieces, next to the king is the queen, after her the rooks, then the bishops, and last of the dignified pieces comes the knight. The difference of the worth of pawns, is not so great as that of noblemen; only, it must be observed, that the king's bishop's pawn is the best in the field, and therefore the skilful gamester will be careful of him. It ought also to be observed, that whereas any man may be taken, when he falls within the reach of any of the adversary's pieces, it is otherwise with the king, who, in such a case, is only to be saluted with the word *check*, warning him of his danger, out of which it is absolutely necessary that he move; and, if it so happen that he cannot move without exposing himself to the like inconveniency, it is check-mate, and the game is lost. The rules of the game are,

1. In order to begin the game, the pawns must be moved before the pieces, and afterwards the pieces must be brought out to support them. The king's, queen's and bishop's pawns, should be moved first, that the game may be well opened; the pieces must not be played out early in the game, because the player may thereby lose

lose his moves: but above all, the game should be well arranged before the queen is played out. Useless checks should also be avoided, unless some advantage is to be gained by them, because the move may be lost, if the adversary can either take or drive the piece away.

2. If the game is crowded, the player will meet with obstructions in moving his pieces; for which reason he should exchange pieces or pawns, and castle (A) his king as soon as it is convenient, endeavouring at the same time to crowd the adversary's game, which may be done by attacking his pieces with the pawns, if the adversary should move his pieces out too soon.

3. The men should be so guarded by one another, that if a man should be lost, the player may have it in his power to take one of the adversary's in return; and if he can take a superior piece in lieu of that which he lost, it would be an advantage, and distress the adversary.

4. The adversary's king should never be attacked without a force sufficient; and if the player's king should be attacked without having it in his power to attack the adversary's, he should offer to make an exchange of pieces, which may cause the adversary to lose a move.

5. The board should be looked over with attention, and the men reconnoitred, so as to be aware of any stroke that the adversary might attempt in consequence of his last move. If, by counting as many moves forward as possible, the player has a prospect of success, he should not fail doing it, and even sacrifice a piece or two to accomplish his end.

6. No man should be played till the board is thoroughly examined, that the player might defend himself against any move the adversary has in view; neither should any attack be made till the consequences of the adversary's next move are considered; and when an attack may with safety be made, it should be pursued without catching at any bait that might be thrown out in order for the adversary to gain a move, and thereby cause the design to miscarry.

7. The queen should never stand in such a manner before the king, that the adversary, by bringing a rook or bishop, could check the king if she were not there; as it might be the loss of the queen.

8. The adversary's knight should never be suffered to check the king and queen, or king and rook, or queen and rook, or the two rooks at the same time; especially if the knight is properly guarded: because, in the two first cases, the king being forced to go out of check, the queen or the rook must be lost; and in the two last cases a rook must be lost at least for a worse piece.

9. The player should take care that no guarded pawn of the adversary's fork two of his pieces.

10. As soon as the kings have castled on different sides of the board, the pawns on that side of the board should be advanced upon the adversary's king, and the pieces, especially the queen and rook, should be brought to support them; and the three pawns belonging to the king that is castled must not be moved.



11. The more moves a player can have as it were in ambuscade, the better; that is to say, the queen, bishop, or rook, is to be placed behind a pawn or a piece, in such a position as that upon playing that pawn or piece a check is discovered upon the adversary's king, by which means a piece or some advantage is often gained.

12. An inferior piece should never be guarded with a superior, when a pawn would answer the same purpose; for this reason, the superior piece may remain out of play; neither should a pawn be guarded with a piece when a pawn would do as well.

13. A well supported pawn that is passed often costs the adversary a piece; and when a pawn or any other advantage is gained without endangering the loss of the move, the player should make as frequent exchanges of pieces as he can. The advantage of a passed pawn is this: for example, if the player and his adversary have each three pawns upon the board, and no piece, and the player has one of his pawns on one side of the board, and the other two on the other side, and the adversary's three pawns are opposite to the player's two pawns, he should march with his king as soon as he can, and take the adversary's pawns: If the adversary goes with his king to support them, the player should go on to queen with his single pawns; and then if the adversary goes to hinder him, he should take the adversary's pawns, and move the others to queen (B).

14. When the game is near finished, each party having only three or four pawns on each side of the board, the kings must endeavour to gain the move in order to win the game. For instance, when the player brings his king opposite to the adversary's with only one square between, he will gain the move.

15. If the adversary has his king and one pawn on the board, and the player has only his king, he cannot lose the game, provided he brings his king opposite to the adversary's, when the adversary is directly before or on one side of his pawn, and there is only one square between the kings.

16. If the adversary has a bishop and one pawn on the rook's line, and this bishop is not of the colour that commands the corner square the pawn is going to, and the player has only his king, if he can get into that corner, he cannot lose; but, on the contrary, may win by a stale (C).

17. If the player has greatly the disadvantage of the game, having only his queen left in play, and his king happens to be in a position to win, as abovementioned, he should keep giving check to the adversary's king, always taking care not to check him where he can interpose any of his pieces that make the stale; by so doing he will at last force the adversary to take his queen, and then he will win the game by being in a stale-mate.

18. The

(A) *Castle his king*, is to cover the king with a castle; which is done by a certain move which each player has a right to whenever he thinks proper.

(B) *To queen*, is to make a queen; that is, to move a pawn into the adversary's back row, which is the rule at this game when the original one is lost.

(C) When the king is blocked up so as to have no move at all.

Chess.

18. The player should never cover a check with a piece that a pawn pushed upon it may take, for fear of getting only the pawn in exchange for the piece.

19. A player should never crowd his adversary up with peices, for fear of giving a stale-mate inadvertently, but always should leave room for his king to move.

By way of corroborating what has been already said with respect to this game, it is necessary to warn a player against playing a timid game. He should never be too much afraid of losing a rook for an inferior piece; because although a rook is a better piece than any other except the queen, it seldom comes into play to be of any great use till at the end of the game; for which reason it is often better to have an inferior piece in play, than a superior one to stand still, or moving to no great purpose. If a piece is moved, and is immediately drove away by a pawn, it may be reckoned a bad move, because the adversary gains a double advantage over the player, in advancing at the same time the other is made to retire; although the first move may not seem of consequence between equal players, yet a move or two more lost after the first makes the game scarcely to be recovered.

There never wants for a variety at this game, provided the pieces have been brought out regular; but if otherwise, it often happens that a player has scarce any thing to play.

Many indifferent players think nothing of the pawns, whereas three pawns together are strong; but four, which constitute a square, with the assistance of other pieces, well managed, make an invincible strength, and in all probability may produce a queen when very much wanted. It is true, that two pawns with a space between are no better than one; and if there should be three over each other in a line, the game cannot be in a worse way. This shows that the pawns are of great consequence, provided they are kept close together.

Some middling players are very apt to risk losing the game in order to recover a piece: this is a mistake; for it is much better to give up a piece and attack the enemy in another quarter; by so doing, the player has a chance of snatching a pawn or two from, or gaining some advantage over, the adversary, whilst his attention is taken up in pursuing this piece.

If the queen and another piece are attacked at the same time, and that by removing the queen the piece must be lost; provided two pieces can be gained in exchange for the queen, the queen should be given up, it being the difference of three pieces, and consequently more than the value of the queen. By losing the queen, the game is not thrown into that disorder which it would otherwise have been: in this case it would be judicious to give the queen for even a piece, or a pawn or two; it being well known among good players, that he who begins the attack, and cannot maintain it, being obliged to retire, generally loses the game.

A player should never be fond of changing without reason, because the adversary, if he is a good player, will ruin his situation, and gain a considerable advantage over him. But rather than lose a move, when a player is stronger than the adversary, it is good play to change, for he thereby increases his strength.

When the game is almost drawn to a conclusion, the player should recollect that his king is a capital piece, and consequently should keep him in motion; by so doing he generally gets the move, and often the game.

As the queen, rook, and bishop, operate at a distance, it is not always necessary in the attack to have them near the adversary's king.

If a man can be taken with different pieces, the player should take his time, and consider which of those pieces is the best to take it with.

If a piece can be taken almost at any time, the player should not be in a hurry about it, but try to make a good move elsewhere before he takes it.

A player should be cautious how he takes his adversary's pawn with his king, as it often happens to be a safe-guard to it.

After all that has been said, it is still necessary for us to advise those who would play well at this game, to be very cool and attentive to the matter in question: for it is impossible that any person in the universe can be capable of playing at chess if their thoughts are employed elsewhere. The laws at this game are,

1. If a player touches his man, he must play it, and if he quits it, he cannot recal it.

2. If by mistake or otherwise a false move is played, and the adversary takes no notice of it till he hath played his next move, it cannot be recalled by either of the parties.

3. If a player misplaces the men, and he plays two moves, it is at the option of the adversary to permit him to begin the game or not.

4. If the adversary plays or discovers a check to a player's king, and gives no notice of it, the player may let him stand still till he does.

5. After the king is moved, a player cannot castle.

Sarasin has an express treatise on the different opinions of the original of the Latin *schacchi*, whence the French *ethecs*, and our *chess*, is formed. Menage is also very full on the same head. Leunclavius take it to come from *Uscoches*, famous Turkish robbers: P. Sirmond, from the German *scachhe*, "theft;" and that from *calculus*. He takes *chess* to be the same with the *ludus latrunculorum* of the Romans, but mistakenly. This opinion is countenanced by Vossius and Salmasius, who derive the word from *calculus*, as used for *latrunculus*. G. Tolosanus derives it from the Hebrew *scach, vallavit et mat mortuus*; whence *check* and *check-mate*. Fabricius says, a celebrated Persian astronomer, one Schatrenscha, invented the game of *chess*; and gave it his own name, which it still bears in that country. Nicod derives it from *scheque*, or *xeque*, a Moorish word for lord, king, and prince. Bochart adds, that *scach* is originally Persian; and that *scach-mat*, in that language, signifies the king is dead.—The opinion of Nicod and Bochart, which is likewise that of Scriverius, appears the most probable.

Mr Twiss mentions a small treatise on chess, written, as he supposes, about 400 years ago; at the end of which is a representation of a round chess-board, with directions for placing the men upon it. In this the knight can cover the 64 squares on the board at as many moves. The board is divided into these 64 parts by four concentric circles, having an empty space in the middle; and each of these is divided into 16 parts. Number 1 is placed in the outermost circle; number 2 in the third circle counting inwards, in the divison to the

the right hand of the former; number 3 is placed in the outermoſt circle, in the diviſion to the right hand of 2; 4 in the third circle counting inwards to the right hand of three; and thus alternately from the firſt to the third, and from the third to the firſt circle, till the round is completed by 16 on the third circle to the left hand of 1. Number 17 is then placed on the diviſion of the innermoſt circle to the right hand of 1; 18 on the ſecond circle counting inwards, to the right hand of 17; and thus alternately from the fourth to the ſecond, and from the ſecond to the fourth circles, until the round is completed by 32, directly below number 1. Number 33 then is placed on the third circle directly to the right hand of number 2; 34 on the fourth circle, to the right hand of 4; and thus alternately between the third and fourth circles, until the round is again completed by 48 on the fourth circle, directly below number 33. The numbers are now placed in a retrograde faſhion; 50 on the outer circle in that diviſion immediately to the right hand of 1; 51 on the third circle, to the left hand of 2, and directly below number 32; 52 is then placed on the outer circle, immediately on the left hand of 1: 53 on the third circle directly to the left hand of 16; and thus alternately on the firſt and third circles, until the laſt round is completed by 64 between the numbers 3 and 5. On this round cheſs-board, ſuppoſing the black king to be placed in number 48 on the fourth circle, the queen ſtands on number 17 at his left hand; the biſhops in 33 and 2; the knights 18 and 47; the caſtles in 3 and 50; the pawns on 19, 4, 49, 64, and 46, 51 32, 1. The white king will then ſtand in 25, oppoſite the black queen; the white queen in 40 oppoſite to the black king, and ſo on. In playing on a board of this kind, it will be found that the power of the caſtle is double to that in the common game, and that of the biſhop only one half; the former having 16 ſquares to range in, and the laſt only four. The king can caſtle only one way; and it is very difficult to bring the game to a concluſion.

With regard to the origin of the game at cheſs, we are much in the dark. Though it came to us from the Saracens, it is by no means probable that they were the original inventors of it. According to ſome it was invented by the celebrated Grecian hero Diomedes. Others ſay, that two Grecian brothers, Ledo and Tyrrheno, were the inventors; and that being much preſſed with hunger, they ſough to alleviate the pain by this amuſement. It is certain, however, that it is a game of very ancient ſtanding, and in former ages has been very faſhionable in every part of Europe; though in this country it is not very common, probably on account of the intenſe application of thought required to play at it. It has long been a favourite of the Icelanders and other northern people. There is little difference between their game and ours.

The game of cheſs has been generally practiſed by the greateſt warriors and generals; and ſome have even ſuppoſed that it was neceſſary for a military man to be well ſkilled in this game. It is a game which has ſomething in it peculiarly intereſting. We read that Tamerlane was a great cheſs-player, and was engaged in a game during the very time of the deciſive battle with Bajazet the Turkiſh emperor, who was defeated and taken priſoner. It is alſo related of Al Amin the khalif of Bagdad, that he was engaged at cheſs with his freedman Kuthar at the time when Al Mamun's forces were carrying on the ſiege of that city with ſo much vigour that it was on the point of being carried by aſſault. Dr Hyde quotes an Arabic hiſtory of the Saracens, in which the khalif is ſaid to have cried out when warned of his danger, Let me alone, for I ſee check-mate againſt Kuthar! We are told that Charles I. was at cheſs when news were brought of the final intention of the Scots to ſell him to the Engliſh; but ſo little was he diſcompoſed by this alarming intelligence, that he continued his game with the utmoſt compoſure; ſo that no perſon could have known that the letter he received had given him information of any thing remarkable. King John was playing at cheſs when the deputies from Rouen came to acquaint him that their city was beſieged by Philip Auguſtus; but he would not hear them until he had finiſhed his game.

The following remarkable anecdote we have from Dr Robertſon in his Hiſtory of Charles V. John Frederic, elector of Saxony, having been taken priſoner by Charles, was condemned to death. The decree was intimated to him while at cheſs with Erneſt of Brunſwic, his fellow-priſoner. After a ſhort pauſe, and making ſome reflections on the irregularity and injuſtice of the emperor's proceedings, he turned to his antagoniſt, whom he challenged to finiſh the game. He played with his uſual ingenuity and attention; and having beat Erneſt, expreſſed all the ſatisfaction that is commonly felt on gaining ſuch victories. He was not, however, put to death, but ſet at liberty after five years confinement.

In the Chronicle of the Mooriſh kings of Granada we find it related, that in 1396, Mehemed Balba ſeized upon the crown in prejudice of his elder brother, and paſſed his life in one continual round of diſaſters. His wars with Caſtile were invariably unſucceſsful; and his death was occaſioned by a poiſoned veſt. Finding his caſe deſperate, he diſpached an officer to the fort of Salobrena to put his brother Juzaf to death, leſt that prince's adherents ſhould form any obſtacle to his ſon's ſucceſſion. The alcayde found the prince playing at cheſs with an *alfaqui* or prieſt. Juzaf begged hard for two hours reſpite, which was denied him; at laſt with great reluctance the officer permitted him to finiſh the game; but before it was finiſhed a meſſenger arrived with the news of the death of Mehemed, and the unanimous election of Juzaf to the crown.

We have a curious anecdote of Ferrand count of Flanders; who having been accuſtomed to amuſe himſelf at cheſs with his wife, and being conſtantly beaten by her, a mutual hatred took place; which came to ſuch an height, that when the count was taken priſoner at the battle of Bovines, ſhe ſuffered him to remain a long time in priſon though ſhe could eaſily have procured his releaſe.

The game of cheſs has undergone conſiderable variations ſince it was firſt invented. We have it on good authority, that among the eaſtern nations, the piece now called the *queen* was formerly called the *vizir* or king's miniſter, and that the powers of the queen herſelf were but very ſmall. The cheſs-boards uſed by Tamerlane were larger, and contained many more ſquares,

squares, than those at present in use. Carrera invented two new pieces to be added to the eight commonly in use. One of these, which he calls *campione*, is placed between the king's knight and castle; the other, named *Centaur*, between the queen's knight and castle, has the move of the bishop and knight united. This invention, however, did not survive its author. In another of this kind, the two additional pieces are called the *centurion* and *decurion;* the former, situated between the king and his bishop, in its move the same with that of the queen, but only for two squares; the latter moves as the bishop, but only one square at a time. This, like the former, died with its inventor. The chess-board of Tamerlane was a parallelogram, having eleven squares one way and twelve the other. In the Memoirs of the late Marshal Keith, we find it related, that he invented an amusement something similar to that of chess, with which the king of Prussia was highly entertained. Several thousand small statues were cast by a founder; and these were ranged opposite to each other as if they had been drawn up in an army; making the different movements with them as in real service in the field.

A very complicated kind of game at chess was invented by the late duke of Rutland. At this the board has 14 squares in breadth and 10 in height, which make in all 140 houses: and there are 14 pawns on each side, which may move either one, two, or three squares the first time. The other pieces were the king, queen, two bishops, two knights, a crowned castle uniting the move of the king and castle, and a common castle. On the other side of the king was a *concubine*, whose move united that of the castle and knight, two bishops, a single knight, a crowned castle, and a common one. In this game the pawns are of very little use; and by the extent of the board, the knights lose much of their value, which consequently renders the game more defective and less interesting than the common one.

There is an amusing variety at the game of chess, in which the king with eight pawns engages the whole set, by being allowed to make two moves for every one of his adversary. In this he is almost certain of coming off victorious; as he can make his first move into check, and the second out of it. Thus he can take the queen when she stands immediately before her king, and then retreat; for he cannot remain in check. He cannot be check-mated unless his adversary has preserved his queen and both castles.

*Chess-Trees, taquets d'aniure;* two pieces of wood bolted perpendicularly, one on the starboard, and another on the larboard, side of the ship. They are used to confine the *clue*, or lower corners of the main-sail; for which purpose there is a hole in the upper part, through which the rope passes that usually extends the clue of the sail to windward. See Tack.

The chess-trees are commonly placed as far before the main-mast as the length of the main-beam.

CHEST, in commerce, a kind of measure, containing an uncertain quantity of several commodities.

A chest of sugar, *v. g.* contains from ten to fifteen hundred weight; a chest of glass, from two hundred to three hundred feet: of Castile soap, from two and an half to three hundred weight; of indigo, from one and an half to two hundred weight, five score to the hundred.

Chest, or *Thorax.* See Anatomy, Part IV.

CHESTER, commonly called *West-Chester*, to distinguish it from many other Chesters in the kingdom; the capital of Cheshire, in England. It is a very ancient city, supposed to have been founded by the Romans; and plainly appears to have been a Roman station by the many antiquities which have been and are still discovered in and about the town. It was among the last places the Romans quitted; and here the Britons maintained their liberty long after the Saxons had got possession of the rest of their country. At present it is a large well-built wealthy city, and carries on a considerable trade. Mr Pennant calls it *a city without parallel*, on account of the singular structure of the four principal streets. They are as if excavated out of the earth, and sunk many feet beneath the surface; the carriages drive far beneath the level of the kitchens on a line with ranges of shops. The houses are mostly of wood, with galleries, piazzas, and covered walls before them; by which not only the shops, but those who are walking about the town, are so hid, that one would imagine there were scarce any inhabitants in it, though it is very populous. But though by this contrivance such as walk the streets are screened from rain, &c. yet the shops are thereby rendered dark and inconvenient. The back courts of all the houses are on a level with the ground; but to go into any of the four principal streets, it is necessary to descend a flight of several steps.

Chester is a bishop's see. It was anciently part of the diocese of Litchfield; one of whose bishops removing the seat of his see hither in the year 1075, occasioned his successors to be frequently styled *bishops of Chester*. But it was not erected into a distinct bishopric until the general dissolution of monasteries, when king Henery VIII. in the year 1541, raised it to this dignity, and allotted the church of the abbey of St Werburgh for the cathedral, styling it the *cathedral church of Christ and the blessed Virgin;* adding the bishopric to the province of Canterbury: but soon after he disjoined it from Canterbury, and added it to the province of York. When this abbey was dissolved, its revenues were valued at L. 1003 : 5 : 11. This diocese contains the entire counties of Chester and Lancaster, part of the counties of Westmoreland, Cumberland, and Yorkshire, two chapelries in Denbyshire, and five parishes in Flintshire; amounting in all to 256 parishes, of which 101 are impropriations. This bishopric is valued in the king's books at L 420 : 1 ; 8, and is computed to be worth annually L.2700; the clergy's tenth amounting to L435 : 12 : 0. To this cathedral belong a dean, two archdeacons, a chancellor, a treasurer, six prebendaries, and other inferior officers and servants. W. Long. 3. 0. N. Lat. 53. 12.

*Chester-le-Street*, the *Cuneacestre* of the Saxons: a small thoroughfare town between Newcastle and Durham, with a good church and fine spire. In the Saxon times this place was greatly respected on account of the relics of St Cuthbert, deposited here by bishop Eardulf, for fear of the Danes, who at that time (about 884) ravaged the country. His shrine became

became afterwards an object of great devotion. King Athelston, on his expedition to Scotland, paid it a visit, to obtain, by entercession of the saint, success on his arms; bestowed a multitude of gifts on the church; and directed, in case he died in his enterprize, that his body should be enterred there. At the time that this place was honoured with the remains of St Cuthbert, the bishopric of Lindesfarn was removed here, and endowed with all the lands between the Tyne and the Were, the present county of Durham. It was styled *St Cuthbert's patrimony*. The inhabitants had great privileges, and always thought themselves exempt from all military duty, except that of defending the body of their saint. Chester-le-street may be considered as the parent of the see of Durham; for when the relics were removed there, the see in 995 followed them. Tanner says, that probably a chapter of monks, or rather secular canons, attended the body at this place from its first arrival; but bishop Beke, in 1286, in honour of the saint, made the church collegiate, and established here a dean and suitable ecclesiastics; and, among other privileges, gives the dean a right of fishing on the Were, and the tythe of fish.

*New* CHESTER, a town in the state of Pennsylvania, and capital of a county of that name. It is seated on the Delaware; and has a fine capacious harbour, admitting vessels of any burden. W. Long. 74. 7. N. Lat. 40. 15.

CHESTERFIELD, a market town of Derbyshire in England, pleasantly situated on a hill between two small rivers. It has the title of an earldom; and a considerable market for corn, lead, and other country commodities. The houses are, for the most part, built of rough stone, and covered with slate. W. Long. 1.25. N. Lat. 53. 20.

CHESTERFIELD (Earl of). See STANHOPE.

CHEVAL *de* FRISE, a large piece of timber pierced, and traversed with wooden spikes, armed or pointed with iron, five or six feet long. See Plate CXXXVI.

The term is French and properly signifies a *Friesland horse*; as having been first invented in that country.—It is also called a *Turnpike* or *Turniquet*.

Its use is to defend a passage, stop a breach, or make a retrenchment to stop the cavalry. It is sometimes also mounted on wheels, with artificial fires, to roll down in an assault. Errard observes, that the prince of Orange used to inclose his camp with *chevaux de Frise*, placing them one over another.

CHEVALER, in the manege, is said of a horse, when, in passaging upon a walk or trot, his off foreleg crosses or overlaps the near fore-leg every second motion.

CHEVALIER, a French term, ordinarily signifying a KNIGHT. The word is formed of the French *cheval*, "horse;" and the barbarous Latin *cavallus*.

It is used, in heraldry, to signify any *cavalier*, or horseman armed at all points; by the Romans called *cataphractus eques*: now out of use, and only to be seen in coat-armour.

CHEVAUX *de* FRISE. See CHEVAL *de Frise*.

CHEVIN, a name used in some parts of England for the CHUB.

CHEVIOT (or TIVIOT) HILLS, run from north to south through Cumberland; and were formerly the borders or boundaries between England and Scotland, where many a bloody battle has been fought between the two nations; one of which is recorded in the ballad of Chevy-chase. These hills are the first land discovered by sailors in coming from the east into Scotland.



CHEVISANCE, in law, denotes an agreement or composition, as an end or order set down between a creditor and his debtor, *&c.* In the statutes, this word is most commonly used for an unlawful bargain or contract.

CHEVREAU (Urban), a learned writer, born at Lundun in 1613. He distinguished himself in his youth by his knowledge of the belles lettres; and became secretary of state to queen Christina of Sweden. Several German princes invited him to their courts; and Charles-Lewis, the elector palatine, retained him under the title of counsellor. After the death of that prince, he returned to France, and became preceptor to the duke of Maine. At length retiring to Lundun, he died there in 1701, aged 88. He was the author of several books; and amongst others, of an Univesal History, which has been often reprinted.

CHEVRON, or CHEVERON, in heraldry. See HERALDRY.

CHEWING-BALLS, a kind of balls made of asafoetida, liver of antimony, bay-wood, juniper-wood, and pellitory of Spain; which being dried in the sun, and wrapped in a linen cloth, are tied to the bit of the bridle for the horse to chew; they create an appetite; and it is said, that balls of Venice-treacle may be used in the same manner with good success.

CHEYKS. See BENGAL, n° 17.

CHEYNE (Dr George), a physician of great learning and abilities, born in Scotland in 1671, and educated at Edinburgh under the great Dr Pitcairn. He passed his youth in close study, and with great temperance: but coming to settle at London, when about 30, and finding the younger gentry and free-livers to be the most easy of access and most susceptible of friendship, he changed on a sudden his former manner of living in order to force a trade, having observed this method to succeed with some others. The consequence was, that he grew daily in bulk, and in intimacy with his gay acquaintance; swelling to such an enormous size, that he exceeded 32 stone weight; and he was forced to have the whole side of his chariot made open to receive him into it; he grew short-breathed, lethargic, nervous, and scorbutic; so that his life became an intolerable burden. In this deplorable condition, after having tried all the power of medicine in vain, he resolved to try a milk and vegetable diet; the good effects of which quickly appeared. His size was reduced almost a third; and he recovered his strength, activity, and cheerfulness, with the perfect use of all his faculties. In short, by a regular adherence to this regimen, he lived to a mature period, dying at Bath in 1742, aged 72. He wrote several treatises that were well received; particularly, "An Essay on Health and Long Life;" and "The English Malady, or a Treatise of Nervous Diseases;" both the result of his own experience. In short, he had great reputation in his own time, both as a practitioner and as a writer; and most of his pieces passed thro' several editions. He is to be ranked among those physicians

physicians who have accounted for the operations of medicines and the morbid alterations which take place in the human body upon mechanical principles. A spirit of piety and of benevolence, and an ardent zeal for the interests of virtue, are predominant throughout his writings. An amiable candour and ingenuousness are also discernible, and which led him to retract with readiness whatever appeared to him to be censurable in what he had formerly advanced. Some of the metaphysical notions which he has introduced into his books, may, perhaps, justly be thought fanciful and ill-grounded; but there is an agreeable vivacity in his productions, together with much openness and frankness, and in general great perspicuity.

CHIABRERA (Gabriel), esteemed the Pindar of Italy, was born at Savona in 1552, and went to study at Rome. The Italian princes, and Urban VIII. gave him public marks of their esteem. He wrote a great number of poems; but his lyric verses are most admired. He died at Savona in 1638, aged 86.

CHIAN EARTH, in pharmacy, one of the medicinal earths of the ancients, the name of which is preserved in the catalogues of the materia medica, but of which nothing more than the name has been known for many ages in the shops.

It is a very dense and compact earth; and is sent hither in small flat pieces from the island of Chios, in which it is found in great plenty at this time. It stands recommended to us as an astringent. They tell us, it is the greatest of all cosmetics; and that it gives a whiteness and smoothness to the skin, and prevents wrinkles, beyond any of the other substances that have been celebrated for the same purposes.

CHIAOUS, a word in the original Turkish, signifying "envoys," are officers to the number of five or six hundred in the grand signior's court, under the command of a chiaous baschi. They frequently meet in the grand visir's palace, that they may be in readiness to execute his orders, and carry his dispatches into all the provinces of the empire. The chiaous baschi assists at the divan, and introduces those who have business there.

CHIAPA, the capital of a province of the same name in Mexico, situated about 300 miles east of Acapulco. W. Long. 98. 0. N. Lat. 16. 30.

*CHIAPA el Real*, a town of Mexico, in a province of the same name, with a bishop's see. Its principal trade consists in chocolate-nuts, cotton, and sugar. W. Long. 98. 35. N. Lat. 16. 20.

*CHIAPAS de los Indos*, a large and rich town of North America, in Mexico, and in a province of the same name. The governor and most of the inhabitants are originally Americans. W. Long. 98. 5. N. Lat. 15. 6.

CHIARI (Joseph), a celebrated Italian painter, was the disciple of Carlo Maratti; and adorned the churches and palaces of Rome with a great number of fine paintings. He died of an apoplexy in 1727, aged 73.

CHIARI, a town of Italy, in the province of Brescia, and territory of Venice, 7 miles west of Brescia, and 27 east of Milan. Here the Imperialists gained a victory over the French in 1701. E. Long. 18. 18. N. Lat. 45. 30.

CHIARO-SCURO. See *Claro-Obscuro*.

CHIAVENNA, a handsome, populous, and large town of Swisserland, in the country of the Grisons. It is a trading place, especially in wine and delicate fruits. The governor's palace and the churches are very magnificent, and the inhabitants are Roman Catholics. It is seated near the lake Como. E. Long. 9. 29. N. Lat. 46. 15.



CHIAUSI, among the Turks, officers employed in executing the vizirs, bashaws, and other great men: the orders for doing this, the grand signior sends them wrapped up in a black cloth; on the reception of which, they immediately perform their office.

CHICANE, or CHICANERY, in law, an abuse of judiciary proceeding, tending to delay the cause, to puzzle the judge, or impose upon the parties.

CHICANE, in the schools, is applied to vain sophisms, distinctions, and subtleties, which protract disputes, and obscure the truth.

CHICHESTER, the capital city of the county of Sussex in England, was built by Cissa, the 2d king of the South Saxons, and by him called *Cissan Caester*. It is surrounded with a wall, which has four gates, answering to the four cardinal points; from which run two streets, that cross one another in the middle and form a square, where the market is kept, and where there is a fine stone piazza built by bishop Read. The space between the west and south gates is taken up with the cathedral church and the bishop's palace. It has five parish-churches; and is seated on the little river Lavant, which washes it on all sides except the north. This city would have been in a much more flourishing condition if it had been built by the sea-side; however, the inhabitants have endeavoured to supply this defect in some measure, by cutting a canal from the city down into the bay. The principal manufactures of the town are malt and needles. The market of Chichester is noted for fish, wheat, barley, malt, and oats; the finest lobsters in England are bred in the Lavant; and it is observable, that this river, unlike most others, is very low in winter, but in summer often overflows its banks. Chichester is a city and county of itself; it is governed by a mayor, recorder, aldermen, common-council without limitation, and four justices of the peace chosen out of the aldermen; and it sends two members to parliament. It is a bishop's see. The cathedral church was anciently dedicated to St Peter. It was new built by Radulph, the twenty-fifth bishop; but being destroyed by fire, it was again built by Seffridus II. the twenty-ninth bishop. This see hath yielded to the church two saints, and to the nation three lord chancellors, two almoners, and one chancellor to the university of Oxford. Anciently the bishops of Chichester were confessors to the queens of England. This diocese contains the whole of the county of Sussex (excepting 22 parishes, peculiars of the archbishop of Canterbury), wherein are 250 parishes, whereof 112 are impropriated. It hath two archdeacons, viz. of Chichester and Lewes; is valued in the king's books at L.677 : 1 : 3, and is computed to be worth annually L.2600. The tenths of the whole clergy is L.287 : 2 : 0¾. To the cathedral belong a bishop, a dean, two archdeacons, a treasurer, a chancellor, thirty-two prebendaries, a chanter, twelve vicars-coral, and other officers. W. Long. 50. N. Lat. 50. 50.

CHICK, or CHICKEN, in zoology, denotes the young

young of the gallinaceous order of birds, especially the common hen. See PHASIANUS.

*CHICK-Weed*, in botany. See ALSINE.

*CHICKEN-Pox*. See *(Index subjoined to)* MEDICINE.

CHICKLING-PEA, in botany, a name given to the LATHYRUS.

CHICUITOS, a province of South America, in the government of Santo-Cruz de la Sierra. The chief riches consist of honey and wax; and the original inhabitants are very voluptuous, yet very warlike. They maintained bloody wars with the Spaniards till 1690; since which, some of them have become Christians. It is bounded by la Plata on the N. E. and by Chili on the W.

CHIDLEY, or CHIMLEY, a market-town of Devonshire, situated in W. Long. 4. 0. N. Lat. 51. 0.

CHIEF, a term signifying the head or principal part of a thing or person. Thus we say, the chief of a party, the chief of a family, &c. The word is formed of the French *chef*, "head;" of the Greek κεφαλη, *caput*, "head;" though Menage derives it from the Italian *capo*, formed of the Latin *caput*.

CHIEF, in heraldry, is that which takes up all the upper part of the escutcheon from side to side, and represents a man's head. *In chief*, imports something borne in the chief part or top of the escutcheon.

CHIEFTAIN, denotes the captain or chief of any class, family, or body of men. Thus the chieftains or chiefs of the Highland clans, were the principal noblemen or gentlemen of their respective clans. See CLANS.

CHIELEFA, a strong town of Turkey in Europe, in the Morea. It was taken by the Venetians in 1685; but after that the Turks retook it, with all the Morea. E. Long. 22. 21. N. Lat. 26. 50.

CHIGI (Fabio), or Pope Alexander VII. was born at Sienna in 1599. His family finding him a hopeful youth, sent him early to Rome, where he soon engaged in a friendship with the marquis Pallavicini, who recommended him so effectually to Pope Urban VIII. that he procured him the post of Inquisitor at Malta. He was sent vice-legate to Ferrara, and afterward nuncio into Germany: there he had an opportunity of displaying his intriguing genius; for he was mediator at Munster, in the long conference held to conclude a peace with Spain. Cardinal Mazarin had some resentment against Chigi, who was soon after made a cardinal and secretary of state by Innocent X. but his resentment was sacrificed to political views. In 1655, when a pope was to be chosen, Cardinal Sacchetti, Mazarin's great friend, finding it was impossible for him to be raised into St Peter's chair because of the powerful opposition made by the Spanish faction, desired Cardinal Mazarin to consent to Chigi's exaltation. His request was granted, and he was elected pope by the votes of all the 64 cardinals who were in the conclave: an unanimity of which there are but few instances in the election of popes. He showed uncommon humility at his election, and at first forbade all his relations to come to Rome without his leave; but he soon became more favourable to his nephews, and loaded them with favours. It is asserted that he had once a mind to turn Protestant. The news-papers in Holland bestowed great encomiums upon him; and acquainted the world, that he did not approve of the cruel persecutions of the Waldenses in Piedmont. There is a volume of his poems extant. He loved the *Belles-Lettres*, and the conversation of learned men. He was extremely fond of stately buildings: the grand plan of the college *Della Sapienza*, which he finished, and adorned with a fine library, remains a proof of his taste in architecture. He died in 1667.



CHILBLAIN, *(pernio)*, in medicine, a tumour affecting the feet and hands; accompanied with an inflammation, pains, and sometimes an ulcer or solution of continuity: in which case it takes the denomination of *chaps* on the hands, and of *kibes* on the heels. Chilblain is compounded of *chill* and *blain*; *q. d.* a blain or sore contracted by cold. *Pernio* is the Latin name adopted by physicians; and is derived by Vossius from *perna* "a gammon of bacon," on account of some resemblance. *Chap* alludes to *gape*, both in sound and appearance. *Kibes*, in welch *kibws*, may be derived from the German *kerben*, "to cut;" the skin, when broke, appearing like a cut.

Chilblains are occasioned by excessive cold stopping the motion of the blood in the capillary arteries. See the article PERNIO.

CHILD, a term of relation to *parent*. See PARENT and CHILDREN.

Bartholine, Paré, Licetus, and many other writers, give an account of a petrified child, which has seemed wholly incredible to some people. The child, however, which they describe, is still in being; and is kept as a great rarity in the king of Denmark's museum at Copenhagen. The woman who was big with this, lived at Sens in Champaign in the year 1582; it was cut out of her belly, and was universally supposed to have lain there about 20 years. That it is a real human fœtus, and not artificial, is evident to the eyes of any observer; and the upper part of it, when examined, is found to be of a substance resembling the gypsum, or stone whereof they make the plaster of Paris: the lower part is much harder; the thighs and buttocks being a perfect stone of a reddish colour, and as hard as common quary-stone: the grain and surface of this part appears exactly like that of the calculi, or stones taken out of human bladders: and the whole substance examined ever so nearly, and felt ever so carefully, appears to be absolute stone. It was carried from Sens to Paris, and there purchased by a goldsmith of Venice; and Frederic III. king of Denmark, purchased it of this man at Venice for a very large sum, and added it to his collection of rarities.

*CHILD-Bed*, } See MIDWIFERY.
*CHILD-Birth*. }

*CHILD-Wit*, a power to take a fine of a bond-woman unlawfully gotten with child, that is, without consent of her lord. Every reputed father of a base child got within the manor of Writtel in Essex, in England, pays to the lord a fine of 3s. 4d.; where, it seems, child-wit extends to free as well as bond-women.

CHILDERMAS-DAY, or *INNOCENT's Day*, an anniversary held by the church of England on the 28th of December, in commemoration of the children of Bethlehem massacred by order of Herod.

CHILDREN, the plural of CHILD.

Mr Derham computes, that marriages, one with another, produce four children, not only in England, but in other parts also.

In the genealogical history of Tuscany, wrote by Gamarini, mention is made of a nobleman of Sienna, named Pichi, who of three wives had 150 *children;* and that, being sent ambassador to the pope and the emperor, he had 48 of his sons in his retinue. In a monument in the church yard of St Innocent, at Paris, erected to a woman who died at 88 years of age, it is recorded, that she might have seen 288 *children* directly issued from her. This exceeds what Hakewell relates of Mrs Honeywood, a gentlewoman of Kent, in England born in the year 1527, and married at 16 to her only husband R. Honeywood, of Charing, Esq; and died in her 93d year. She had 16 *children* of her own body; of which three died young, and a fourth had no issue: yet her *grandchildren*, in the second generation, amounted to 114; in the third, to 228; though in the fourth, they fell to 9. The whole number she might have seen in her life-time, being 367. $16+114+228+9=367$. So that she could say the same as the distich does of one of the Dalburg's family at Basil:

1 2 3 4
*Mater ait natæ dic natæ filia natam,*
5 6
*Ut moneat, natæ, plangere, filiolam.*

*Management of* CHILDREN See INFANT.

*Overlaying of* CHILDREN, is a misfortune that frequently happens; to prevent which, the Florentines have contrived an instrument called *arcuccio*. See ARCUCCIO.

CHILDREN are, in law, a man's issue begotten on his wife. As to *illegitimate children*, see BASTARD.

For the legal duties of parents to their children, see the articles PARENT and BASTARD.

As to the duties of children to their parents, they arise from a principle of natural justice and retribution. For to those who gave us existence, we naturally owe subjection and obedience during our minority, and honour and reverence ever after: they who protected the weakness of our infancy, are intitled to our protection in the infirmity of their age; they who by sustenance and education have enabled their offspring to prosper, ought, in return, to be supported by that offspring, in case they stand in need of assistance. Upon this principle proceed all the duties of children to their parents, which are enjoined by positive laws. And the Athenian laws carried this principle into practice with a scrupulous kind of nicety: obliging all children to provide for their father when fallen into poverty; with an exception to spurious children, to those whose chastity had been prostituted with consent of their father, and to those whom he had not put in any way of gaining a livelihood. The legislature, says baron Montesquieu, considered, that, in the first case, the father, being uncertain, had rendered the natural obligation precarious; that, in the second case, he had sullied the life he had given, and done his children the greatest of injuries, in depriving them of their reputation; and that, in the third case, he had rendered their life (so far as in him lay) an insupportable burden, by furnishing them with no means of subsistence.

Our laws agree with those of Athens, with regard to the first only of these particulars, the case of spurious issue. In the other cases, the law does not hold the tie of nature to be dissolved by any misbehaviour of the parent; and therefore a child is equally justifiable in defending the person, or maintaining the the cause or suit, of a bad parent as of a good one; and is equally compellable, if of sufficient ability, to maintain and provide for a wicked and unnatural progenitor, as for one who has shown the greatest tenderness and paternal piety. See further the article *FILIAL Affection*.



CHILI, a province of South America, bounded by Peru on the north, by the province of La Plata on the east, by Patagonia on the south, and by the Pacific ocean on the west, lying between 75 and 85 degrees of west longitude, and between 25 and 45 degrees of south latitude; though some comprehend in this province Patagonia and Terra del Fuego.

The first attempt of the Spaniards upon this country was made by Almagro in the year 1535, after he and Pizaro had completed the conquest of Peru. He set out on his expedition to Chili with a considerable body of Spaniards and auxiliary Indians. For 200 leagues he was well accommodated with every necessary by the Indians, who had been subjects of the emperors of Peru: but reaching the barren country of Charcas, his troops became discontented through the hardships they suffered; which determined Almagro to climb the mountains called Cordilleras, in order to get the sooner into Chili; being ignorant of the invaluable mines of Potosi, contained in the province of Charcas where he then was. At that time the Cordilleras were covered with snow, the depth of which obliged him to dig his way through it. The cold made such an impression on his naked Indians, that it is computed no less than 10,000 of them perished on these dreadful mountains, 150 of the Spaniards sharing the same fate; while many of the survivors lost their fingers and toes through the excess of cold. At last, after encountering incredible difficulties, Almagro reached a fine, temperate, and fertile plain on the opposite side of the Cordilleras, where he was received with the greatest kindness by the natives. These poor savages, taking the Spaniards for deputies of their god Virachoca, immediately collected for them an offering of gold and silver worth 200,000 ducats: and soon after brought a present to Almagro worth 300,000 more. These offerings only determined him to conquer the whole country as soon as possible. The Indians among whom he now was, had acknowledged the authority of the Peruvian incas, or emperors, and consequently gave Almagro no trouble. He therefore marched immediately against those who had never been conquered by the Peruvians, and inhabited the southern parts of Chili. These savages fought with great resolution, and disputed every inch of ground: but in five months time the Spaniards had made such progress, that they must infallibly have reduced the whole province in a very little time, had not Almagro returned to Peru, in consequence of a commission sent him from Spain.

In 1540, Pizaro having overcome and put Almagro to death, sent into Chili, Baldivia, or Valdivia, who had learned the rudiments of war in Italy, and was reckoned one of the best officers in the Spanish service. As he penetrated southwards, however, he met with much opposition; the confederated caziques frequently gave him battle, and displayed great courage.

Chili.

rage and resolution; but could not prevent him from penetrating to the valley of Masiocho, which he found incredibly fertile and populous. Here he founded the city of St Jago; and finding gold mines in the neighbourhood, forced the Indians to work in them; at the same time building a castle for the safety and protection of his new colony. The natives, exasperated at this slavery, immediately took up arms; attacked the fort; and, though defeated and repulsed, set fire to the outworks, which contained all the provisions of the Spaniards. Nor were they discouraged by this and many other defeats, but still continued to carry on the war with vigour. At last, Valdivia, having overcome them in many battles, forced the inhabitants of the vale to submit; upon which he immediately set them to work in the mines of Quilotta. This indignity offered to their countrymen redoubled the fury of those who remained at liberty. Their utmost efforts, however, were as yet unable to stop Valdivia's progress. Having crossed the large rivers Maulle and Hata, he traversed a vast tract of country, and founded the city of La Conception on the South-sea-coast. He erected fortresses in several parts of the country, in order to keep the natives in awe; and built the city called *Imperial*, about 40 leagues to the southward of Conception. The Spanish writers say that the neighbouring valley contained 80,000 inhabitants of a peaceable disposition; and who were even so tame as to suffer Valdivia to parcel out their lands among his followers, while they themselves remained in a state of inactivity. About 16 leagues to the eastward of Imperial, the Spanish general laid the foundations of the city *Villa Rica*, so called on account of the rich gold mines he found there. But his ambition and avarice had now involved him in difficulties from which he could never be extricated: He had extended his conquests beyond what his strength was capable of maintaining. The Chilesians were still as desirous as ever of recovering their liberties. The horses, fire-arms, and armour of the Spaniards, indeed, appeared dreadful to them; but thoughts of endless slavery were still more so. In the course of the war they had discovered that the Spaniards were vulnerable and mortal men like themselves; they hoped, therefore, by dint of their superiority in numbers, to be able to expel the tyrannical usurpers. Had all the nations joined in this resolution, the Spaniards had certainly been exterminated; but some of them were of a pacific and fearful disposition, while others considered servitude as the greatest of all possible calamities. Of this last opinion were the Araceans, the most intrepid people in Chili, and who had given Valdivia the greatest trouble. They all rose to a man, and chose Capaulican, a renowned hero among them, for their leader. Valdivia, however, received notice of their revolt sooner than they intended he should, and returned with all expedition to the vale of Araccea; but before he arrived, 14,000 of the Chilesians were there assembled under the conduct of Capaulican. He attacked them with his cavalry, and forced them to retreat into the woods; but could not obtain a complete victory, as they kept continually sallying out and harassing his men. At last Capaulican, having observed that fighting with such a number of undisciplined troops only served to contribute to the defeat and confusion of the whole, divided his forces into bodies of 1000 each. These he directed to attack the enemy by turns; and, though he did not expect that a single thousand would put them to flight, he directed them to make as long a stand as they could; when they were to be relieved and supported by another body; and thus the Spaniards would be at last wearied out and overcome. The event fully answered his expectations. The Chilesians maintained a fight for seven or eight hours, until the Spaniards, growing faint for want of refreshment, retired precipitately. Valdivia ordered them to possess a pass at some distance from the field, to stop the pursuit; but this design being discovered to the Chilesians by the treachery of his page, who was a native of that country, the Spaniards were surrounded on all sides, and cut in pieces by the Indians. The general was taken and put to death: some say with the tortures usually inflicted by those savages on their prisoners; others, that he had melted gold poured down his throat; but all agree, that the Indians made flutes and other instruments of his bones, and preserved his skull as a monument of their victory, which they celebrated by an annual festival. After this victory the Chilesians had another engagement with their enemies; in which also they proved victorious, defeating the Spaniards with the loss of near 3000 men; and upon this they bent their whole force against the colonies. The city of Conception, being abandoned by the Spaniards, was taken and destroyed: but the Indians were forced to raise the siege of Imperial; and their progress was at last stopped by Garcia de Mendoza, who defeated Capaulican, took him prisoner, and put him to death. No defeats, however, could dispirit the Chilesians. They continued the war for 50 years; and to this day they remain unconquered, and give the Spaniards more trouble than any other American nation. Their most irreconcileable enemies are the inhabitants or Araccea and Tucapel, those to the south of the river Bobio, or whose country extends towards the Cordilleras — The manners of these people greatly resemble those of North America, which we have already described under the article AMERICA; but seem to have a more warlike disposition. It is a constant rule with the Chilesians never to sue for peace. The Spaniards are obliged not only to make the first overtures, but to purchase it by presents. They have at last been obliged to abandon all thoughts of extending their conquests, and reduced to cover their frontiers by erecting forts at proper distances.

The Spanish colonies in Chili are dispersed on the borders of the South-sea. They are parted from Peru by a desart 80 leagues in breadth; and bounded by the island of Chiloe, at the extremity next the straits of Magellan. There are no settlements on the coasts except that of Baldivia, Conception island, Valparaiso, and Coquimbo or La Serena, which are all sea-ports. In the inland country is St Jago, the capital of the colony. There is no culture nor habitation at any distance from these towns. The buildings in the whole province are low, made of unburnt brick, and mostly thatched. This practice is observed on account of the frequent earthquakes; and is properly adapted to the nature of the climate, as well as the indolence of the inhabitants.

The climate of Chili is one of the most wholesome

in

in the whole world. The vicinity of the Cordilleras gives it such a delightful temperature as could not otherwise be expected in that latitude. Though gold mines are found in it, their richness has been too much extolled; their produce never exceeds L. 218,750. The soil is prodigiously fertile. All the European fruits have improved in that happy climate. The wine would be excellent if nature were properly assisted by art: and the corn-harvest is reckoned a bad one when it does not yield a hundred fold. With all these advantages, Chili has no direct intercourse with the mother-country. Their trade is confined to Peru, Paraguay, and the savages on their frontiers. With these last they exchange their less valuable commodities, for oxen, horses, and their own children, whom they are ready to part with for the most trifling things. This province supplies Peru with great plenty of hides, dried fruit, copper, salt-meat, horses, hemp, lard, wheat, and gold. In exchange, it receives tobacco, sugar, cocoa, earthen-ware, woollen cloth, linen, hats, made at Quito, and every article of luxury brought from Europe. The ships sent from Callao on this traffic were formerly bound to Conception Bay, but now come to Valparaiso. The commerce between this province and Paraguay is carried on by land, though it is a journey of 300 leagues, 40 of which lie through the snows and precipices of Cordilleras; but if it was carried on by sea, they must either pass the straits of Magellan or double Cape Horn, which the Spaniards always avoid as much as possible. To Paraguay are sent some woollen stuffs called *ponchos*, which are used for cloaks; also wines, brandy, oil, and chiefly gold. In return they receive wax, a kind of tallow fit to make soap, European goods, and negroes.

Chili is governed by a chief, who is absolute in all civil, political, and military affairs, and is also independent of the viceroy. The latter has no authority except when a governor dies; in which case he may appoint one in his room for a time, till the mother-country names a successor. If, on some occasions, the viceroy has interfered in the government of Chili, it was when he has been either authorised by a particular trust reposed in him by the court, or by the deference paid to the eminence of his office; or when he has been actuated by his own ambition to extend his authority. In the whole province of Chili there are not 20,000 white men, and not more than 60,000 negroes, or Indians, able to bear arms. The military establishment amounted formerly to 2000 men; but the maintaining of them being found too expensive, they were reduced to 500 at the beginning of this century.

CHILIAD, an assemblage of several things ranged by thousands. The word is formed of the Greek χιλιας, *mille*, a thousand.

CHILIAGON, in geometry, a regular plain figure of 1000 sides and angles. Though the imagination cannot form the idea of such a figure, yet we may have a very clear notion of it in the mind, and can easily demonstrate that the sum of all its angles is equal to 1996 right ones: for the internal angles of every plane figure are equal to twice as many right ones as the figure hath sides, except those four which are about the centre of the figure, from whence it may be resolved into as many triangles as it has sides. The author of *l'Art de Penser*, p. 44. has brought this instance to show the distinction between imagination and conceiving.



CHILIARCHA, or CHILIARCHUS, an officer in the armies of the ancients, who had the command of a thousand men.

CHILIASTS, in church-history. See MILLENARIANS.

CHILLINGWORTH (William), an eminent divine of the church of England, was born at Oxford in 1602, and bred there. He made early great proficiency in his studies, being of a very quick genius. He was an expert mathematician, as well as an able divine, and a very good poet. Study and conversation at the university turning upon the controversy between the church of England and that of Rome, on account of the king's marriage with Henrietta daughter to Henry IV. king of France, Mr Chillingworth forsook the church of England, and embraced the Romish religion. Dr Laud, then bishop of London, hearing of this, and being greatly concerned at it, wrote Mr Chillingworth; who expressing a great deal of candour and impartiality, that prelate continued to correspond with him. This set Mr Chillingworth on a new inquiry; and at last determined him to return to his former religion. In 1634 he wrote a confutation of the arguments which had induced him to go over to the church of Rome. He spoke freely to his friends of all the difficulties that occurred to him; which gave occasion to a groundless report, that he had turned Papist a second time, and then Protestant again. His return to the communion of the church of England made a great noise, and engaged him in several disputes with those of the Romish persuasion. But in 1635 he engaged in a work which gave him a far greater opportunity to confute the principles of the church of Rome, and to vindicate the Protestant religion, under the title of "The Religion of Protestants a safe way to Salvation." Sir Thomas Coventry, lord keeper of the great seal, offering him preferment, Mr Chillingworth refused to accept it on account of his scruples with regard to the subscription of the 39 articles. However, he at last surmounted these scruples; and being promoted to the chancellorship of the church of Sarum, with the prebend of Brixworth in Northamptonshire annexed to it, he complied with the usual subscription. Mr Chillingworth was zealously attached to the royal party; and, in August 1643, was present in king Charles I.'s army at the siege of Gloucester, where he advised and directed the making certain engines for assaulting the town. Soon after, having accompanied the Lord Hopton, general of the king's forces in the west, to Arundel castle in Sussex, he was there taken prisoner by the parliamentary forces under the command of Sir William Waller, who obliged the castle to surrender. But his illness increasing, he obtained leave to be conveyed to Chichester, where he was lodged at the bishop's palace; and, after a short sickness, died in 1644. He hath left several excellent works behind him.

CHILMINAR. See PERSEPOLIS.

CHILO, one of the seven sages of Greece, and of the ephori of Sparta the place of his birth, flourished about 556 years before Christ. He was accustomed to say, that there were three things very difficult: "To keep a secret; to know how best to employ our time; and to suffer injuries without murmuring." According to Pliny, it was he who caused the short sentence, *Know thyself*, to be written in letters of gold in the temple of Delphos. It is said that he died with joy, while embracing his son, who had been crowned at the Olympic games.

CHILOE, an island lying near the coast of Chili, in South America, under the 43d degree of south latitude. It is the chief of an archipelago of 40 islands, and its principal town is Castro. It rains here almost all the year, insomuch that nothing but Indian corn, or some such grain, that requires but little heat to ripen it, can ever come to perfection. They have excellent shell-fish, very good wild-fowl, hogs, sheep, and beeves; as also a great deal of honey and wax. They carry on a trade with Peru and Chili; whither they send boards of cedar, of which they have vast forests.

CHILTENHAM, a town in Gloucestershire, England, six miles from Gloucester; noted for its purgative chalybeat spring, which has rendered it of late years a place of fashionable resort. This water, which operates with great ease, is deemed excellent in scorbutic complaints, and has been used with success in the gravel.

CHILTERN, a chain of chalky hills forming the southern part of Buckinghamshire, England, the northern part of the county being distinguished by the name of the *Vale*. The air on these heights is extremely healthful: The soil, though stoney, produces good crops of wheat and barley; and in many places it is covered with thick woods, among which are great quantities of beach.—*Chiltern* is also applied to the hilly parts of Berkshire, and it is believed has the same meaning in some other counties. Hence the HUNDREDS lying in those parts are called the *Chiltern Hundreds*.

*CHILTERN Hundreds (Stewards of.)* Of the Hundreds into which many of the English counties were divided by King Alfred, for the better government, the jurisdiction was originally vested in peculiar courts, but came afterwards to be devolved to the county courts; and so remains at present, excepting with regard to some, as the *chilterns*, which have been by privilege annexed to the crown. These having still their own courts, a *Steward* of those courts is appointed by the chancellor of the exchequer, with a salary of 20s. and all fees, &c. belonging to the office: And this is deemed an appointment of such profit, as to vacate a seat in parliament.

CHIMÆRA, a port-town of Turkey in Europe, situated at the entrance of the gulph of Venice, in the province of Epirus, about 32 miles north of the city Corfu, near which are the mountains of Chimæra, which divide Epirus from Thessaly. E. Long. 20. 40. N. Lat. 40. 20.

CHIMÆRA, in fabulous history, a celebrated monster, sprung from Echidna and Typhon. It had three heads; that of a lion, a goat, and a dragon; and continually vomited flames. The foreparts of its body were those of a lion, the middle was that of a goat, and the hinder parts were those of a dragon. It generally lived in Lycia, about the reign of Jobates, by whose orders Bellerophon, mounted on the horse Pegasus, overcame it. This fabulous tradition is explained by the recollection that there was a burning mountain in Lycia, whose top was the resort of lions on account of its desolate wilderness; the middle, which was fruitful, was covered with goats; and at the bottom the marshy ground abounded with serpents. Bellerophon is said to have conquered the Chimæra, because he destroyed the wild beasts on that mountain, and rendered it habitable. Plutarch says that it was the captain of some pirates who adorned their ship with the images of a lion, a goat, and a dragon.



By a *chimæra*, among the philosophers, is understood a mere creature of the imagination, composed of such contradictions and absurdities as cannot possibly any where exist but in thought.

CHIMES of a CLOCK, a kind of periodical music, produced at equal intervals of time, by means of a particular apparatus added to a clock.

In order to calculate numbers for the chimes, and adapt the chime-barrel, it must be observed, that the barrel must turn round in the same time that the tune it is to play requires in singing. As for the chime-barrel, it may be made up of certain bars that run athwart it, with a convenient number of holes punched in them to put in the pins that are to draw each hammer: and these pins, in order, to play the time of the tune rightly, must stand upright, or hang down from the bar, some more, some less. To place the pins rightly, you may proceed by the way of changes on bells, viz. 1, 2, 3, 4; or rather make use of the musical notes. Observe what is the compass of your tune, and divide the barrel accordingly from end to end.

Thus, in the examples on Plate CXXXVII. each of the tunes is eight notes in compass; and accordingly the barrel is divided into eight parts. These divisions are struck round the barrel; opposite to which are the hammer-tails.

We speak here as if there were only one hammer to each bell, that it may be more clearly apprehended; but when two notes of the same sound come together in a tune, there must be two hammers to the bell to strike it: so that if in all the tunes you intend to chime of eight notes compass, there should happen to be such double notes on every bell, instead of eight you must have sixteen hammers; and accordingly you must divide the barrel, and strike sixteen strokes round it, opposite to each hammer-tail: then you are to divide it round about into as many divisions as there are musical bars, semibreves, minims, &c. in the tune.

Thus the hundredth-psalm tune has 20 semibreves, and each division of it is a semibreve: the first note of it also is a semibreve: and, therefore, on the chime-barrel must be a whole division, from five to five, as your may understand plainly, if you conceive the surface of a chime-barrel to be represented by the above figures, as if the cylindrical superficies of the barrel were stretched out at length, or extended on a plane: and then such a table, so divided, if it were to be wrapped round the barrel, would show the places where all the pins are to stand in the barrel; for the dots running about the table are the places of the pins that play the tune.

Indeed, if the chimes are to be complete, you ought to have a set of bells to the gamut notes; so as that each bell having the true sound of *sol, la, mi, fa*, you may play any tune with its flats and sharps: nay, you may by this means play both the bass and treble with one barrel: and by setting the names of your bells at the

Chimney. the head of any tune, that tune may easily be transferred to the chime-barrel, without any skill in music; but it must be observed, that each line in the music is three notes distant; that is, there is a note between each line, as well as upon it.

CHIMNEY, in architecture, a particular part of a house, where the fire is made, having a tube or funnel to carry off the smoke. The word *chimney* comes from the French *cheminee*; and that from the Latin *caminata*, "a chamber wherein is a chimney:" *caminata*, again, comes from *caminous*; and that from the Greek καμινος, "a chimney;" of καιω, *uro* "I burn."

Chimneys are usually supposed a modern invention; the ancients only making use of stoves: but Octavio Ferrari endeavours to prove chimneys in use among the ancients. To this end, he cites the authority of Virgil,

*Et jam summa procul villarum culmina fumant:*

and that of Appian, who says, "That of those persons proscribed by the triumvirate, some hid themselves in wells and common sewers, and some on the tops of houses and chimneys;" for so he understands καπνωδεις υπωροφιας, *fumaria sub tecto posita*. Add, that Aristophanes, in one of his comedies, introduces his old man, Polycleon, shut up in a chamber, whence he endeavours to make his escape by the *chimney*. However, the few instances remaining among the ancients, together with the obscurity of the rules of Vitruvius on this head, make us rather conclude the use of stoves, whereof the ancients had entire apartments, induced them to neglect this part of building which the coldness of our climates obliges us to have a principal regard to.

*Method of Building* CHIMNEYS *that will not smoke*. Workmen have different methods of drawing up the funnels of chimneys, generally according to their own fancies and judgements, and sometimes according to the customs of places. They are seldom directed by sound and rational principles. It will be found for the most part, that the smoking of chimneys is owing to their being carried up narrower near the top than below, or zig-zag, all in angles: in some cases, indeed, it is owing to accidental causes; but, for the most part, to those two abovementioned. Where they are carried up in pyramid or tapering form, especially if the house be of a considerable height, it is ten to one but they sometimes smoke. The air in the rooms, being rarified, is forced into the funnel of the chimney, and receives from the fire an additional force to carry up the smoke. Now, it is evident, that the further up the smoke flies, the less is the force that drives it, the slower it must move, and consequently the more room in proportion it should have to move in; whereas in the usual way it has less, by the sides of the chimney being gathered closer and closer together.

The method here proposed of carrying up chimneys will be objected to by some thus: The wider a chimney is at the top, say they, the more liberty has the wind to blow down. Very true; but is it not resisted in going down, both by the form of the chimney and other evident causes, so that it must return again? In the other way, when the wind blows down, the resistance being less, the wind and smoke are, if we may use the expression, imprisoned, and make the smoke puff out below. This method has proved effectual after all others had failed: and that in a house placed in the worst situation possible, namely, under a high mountain to the southward, from which strong blasts blow down upon it. A vent was carried up without angles, as perpendicular as possible; and was made about three or four inches wider at top than at the bottom: the funnel was gathered in a throat directly above the fire-place, and so widening upwards. Since that time the house has not only ceased to smoke, but when the doors stand open, the draught is so strong that it will carry a piece of paper out at the chimney-head. See more on this subject under the article SMOKE.

Chimney ‖ China.

*CHIMNEY-Money*, otherwise called *Hearth-money*, a duty in England on houses. By stat. 14. Char. II. cap. 2. every fire-hearth, and stove of every dwelling or other house, within England and Wales (except such as pay not to church and poor), was chargeable with 2 s. *per annum*, payable at Michaelmas and Lady-day to the king and his heirs and successors *&c.*; which payment was commonly called *chimney-money*. This tax, being much complained of as burdensome to the people, has been since taken off, and others imposed in its stead; among which that on windows has by some been esteemed almost equally grievous.

CHIMPANZEE, in natural history. See SIMIA.

CHINA, a country of Asia, situated on the most easterly part of that continent. It is bounded on the north by Tartary; from which it is divided, partly by a prodigious wall of 1500 miles in length, and partly by high, craggy, and inaccessible mountains. On the east, it is bounded by the occean; on the west, by part of the Mogul's empire, and India beyond the Ganges, from which it is parted by other ridges of high mountains and sandy deserts. On the south, it is bounded partly by the kingdoms of Lao, Tonquin, Ava, and Cochin-China, and partly by the southern or Indian sea, which flows between it and the Philippine islands. There are several ways of computing its length and breadth. According to some of these, it is reckoned 1268, 1600, or 1800 miles in length, and as much in breadth; however, by the best and latest accounts, this vast country is somewhat of an oval form, the breadth being less than the length by little more than a fourth-part. It contains 15 provinces, exclusive of that of Lyau-tong, which is situated without the great wall, though under the same dominion. Their names are, 1. Shensi; 2. Shansi; 3. Pecheli; which are situated on the north side, along the wall. 4. Shantong; 5. Kyan-nang; 6. Che-Kyang; 7. Fo-keyn: which are situated along the eastern ocean. 8. Quangtong: 9. Quangsi; 10. Yu-nan; 11. Se-chuen; which stretch themselves towards the south and south-west. And, 12. Ho-nan; 13. Hu-quand; 14. Quey-chew; 15 Kyang-si; which take up the middle part. For a particular description of all these, see their proper articles.

1 Boundaries Extent, &c.

2 Division into provinces.

The origin of all nations is involved in obscurity and fable; but that of the Chinese much more so than any other. Every nation is inclined to assume too high an antiquity to itself, but the Chinese carry theirs beyond all bounds. Indeed, though no people on earth are more exact in keeping records of every memorable

3 Chinese pretensions to antiquity.

China.

morable transaction, yet such is the genius of the Chinese for superstition and fable, that the first part of their history is deservedly contemned by every rational person. What contributes more to the uncertainty of the Chinese history is, that neither we, nor they themselves, have any thing but fragments of their ancient historical books; for about 213 years before Christ, the reigning emperor of Si-whang-ti caused all the books in the empire to be burned, except those written by laywers and physicians. Nay, the more effectually to destroy the memory of every thing contained in them, he commanded a great number of learned men to be buried alive, lest, from their memories, they should commit to writing something of the true memoirs of the empire. The inaccuracy of the Chinese annals is complained of even by their most respected author, Confucius himself; who also affirms, that, before his time, many of the oldest materials for writing such annals had been destroyed.

4 Why their history is so uncertain.

5 Fabulous history of China.

According to the Chinese histories, the first monarch of the whole universe (that is, of China), was called *Puon-ku*, or *Puen-cu*, This, according to some, was the first man; but according to Bayer and Menzelius, two of the greatest critics in Chinese literature that have hitherto appeared, the word signifies *the highest antiquity*. Puon-ku was succeeded by *Tiene-hoang*, which signifies *the emperor of heaven*. They call him also the intelligent heaven, the supreme king of the middle heaven, *&c.* According to some of their historians, he was the inventor of letters, and of the Cyclic characters by which they determine the place of the year, *&c.* Tiene-hoang was succeeded by Ti-hoang (the emperor of the earth), who divided the day and night, appointing 30 days to make one moon, and fixed the winter solstice to the 11th moon. Ti-hoang was succeeded by Gine-hoang (sovereign of men), who with his nine brothers shared the government among them. They built cities, and surrounded them with walls; made a distinction between the sovereign and subjects; instituted marriage, *&c.*

The reigns of these four emperors make up one of what the Chinese called *ki*, "ages," or "periods," of which there were nine before Fo-hi, whom their most sensible people acknowledge as the founder of their empire.

The history of the second *ki* contradicts almost every thing said of the first; for though we have but just now been told that Gine-hoang and his brethren built cities surrounded with walls; yet, in the succeeding age, the people dwelt in caves, or perched upon trees as it were in nests. Of the third *ki* we hear nothing; and in the fourth, it seems matters had been still worse, as we are told that men were then only taught to retire into the hollows of rocks. Of the fifth and sixth we have no account. These six periods, according to some writers, contained 90,000 years; according to others, 1,100,750.

In the seventh and eighth *ki*, they tell us over again what they had said of the first; namely, that men began to leave their caves and dwell in houses, and were taught to prepare cloths, *&c.* Tchine-fang, the first monarch of the eighth *ki*, tought his subject to take off the hair from skins with rollers of wood, and cover themselves with the skins so prepared. He taught them also to make a kind of web of their hair, to serve as a covering to their heads against rain. They obeyed his orders with joy, and he called his subjects *people clothed with skins*. His reign lasted 350 years; that of one of his successors, also, named Yeou-tsao-chi, lasted more than 300; and his family continued for 12 or 18,000 years. But what is very surprising, all these thousands and millions of years had elapsed without mankind's having any knowledge of fire. This was not discovered till towards the close of this period, by one Souigine. After so useful a discovery, he taught the people to dress their victuals; whereas before, they had devoured the flesh of animals quite raw, drank their blood, and swallowed even their hair and feathers. He is also said to have been the inventor of fishing, letters, *&c.*

In the ninth period we find the invention, or at least the origin of letters, attributed to one Tsang-hie, who received them from a divine tortoise that carried them on his shell, and delivered them into the hands of Tsang-hie. During this period also, music, money, carriages, merchandize, and commerce, *&c.* were invented. There are various calculations of the length of these *ki* or periods. Some make the time from Puon-ku to Confucius, who flourished about 479 years before Christ, to contain 279,000 years; others, 2,276,000; some, 2,759,860 years; others, 3,276,000; and some no less than 96,961,740 years.

6 Fabulous history explained.

These extravagant accounts are by some thought to contain obscure and imperfect hints concerning the cosmogony and creation of the world, *&c.* Puon-ku, the first emperor, they think, represents eternity preceding the duration of the world. The succeeding ones, Tiene-hoang, Ti-hoang, and Gine-hoang, they imagine, signify the creation of the heavens and earth, and the formation of man. The ten *ki*, or ages, nine of which preceded Fo-hi, mean the ten generations preceding Noah. This may very possibly be the case; for about 300 years before Christ, some Jews travelled into China, who might have made the Mosaic writings known there.

What we have now related, contains the substance of that part of the Chinese history which is entirely fabulous. After the nine *ki* or "ages" already taken notice of, the tenth commenced with Fo-hi; and the history, though still very dark, obscrue, and fabulous, begins to grow somewhat more consistent and intelligible. Fo-hi was born in the province of Shensi. His mother walking upon the banks of a lake in that province, saw a very large print of a man's foot in the sand there; and, being surrounded by an iris or rainbow, became impregnated. The child was named *Fo-hi*; and, when he grew up, was by his countrymen elected king on account of his superior merit, and styled *Tyent-tse*, that is "the son of heaven." He invented the eight *qua*, or symbols, consisting of three lines each, which, differently combined, formed 64 characters that were made use of to express every thing. To give these the greater credit, he pretended that he had seen them inscribed on the back of a dragon-horse (an animal shaped like a horse, with the wings and scales of a dragon), which arose from the bottom of a lake. Having gained great reputation among his countrymen by this prodigy, he is said to have created

7 Reign of Fo-hi.

manda-

mandarins or officers, under the name of *dragons*. Hence we may assign a reason why the emperors of China always carry a dragon in their banners. He also instituted marriage, invented music, *&c.* Having established a prime minister, he divided the government of his dominions among four mandarins, and died after a reign of 115 years.

8 Miraculous solstice.

After Fo-hi followed a succession of emperors, of whom nothing remarkable is recorded, except that in the reign of *Yau*, the seventh after Fo-hi, the sun did not set for ten days, so that the Chinese were afraid of a general conflagration.

9 Hypothesis concerning this solstice and Fo-hi.

This event the compilers of the Universal History take to be the same with that mentioned in the book of Joshua, when the sun and moon stood still for about the space of a day. Fo-hi, they will have to be the same with Noah. They imagine, that after the deluge, this patriarch remained some time with his descendents; but on their wicked combination to build the tower of Babel, he separated himself from them with as many as he could persuade to go along with him; and that, still travelling eastward, he at last entered the fertile country of China, and laid the foundation of that vast empire—But, leaving these fabulous and conjectured times, we shall proceed to give some account of that part of the Chinese history, which may be more certainly depended on.

As the Chinese, contrary to the practice of almost all nations, have never sought to conquer other countries, but rather to improve and content themselves with their own, their history for many ages furnishes nothing remarkable. The whole of their emperors, abstracting from those who are said to have reigned in the fabulous times, are comprehended in 22 dynasties, mentioned in the following table.

| | Emperors. | Before Christ. |
|---|---|---|
| 1. *Hya*, containing | 16 | 2207. |
| 2. *Shang*, or *Ing*, | 28 | 1766. |
| 3. *Chew*, | 35 | 1122. |
| 4. *Tsin*, | 4 | 248. |
| 5. *Han*, | 25 | 206. |
| | | After Christ. |
| 6. *Hew-han*, | 2 | 220. |
| 7. *Tsin*, | 15 | 465. |
| 8. *Song*, | 8 | 220. |
| 9. *Tsi*, | 5 | 479. |
| 10. *Lyang*, | 4 | 502. |
| 11. *Chin*, | 4 | 557. |
| 12. *Swi*, | 3 | |
| 13. *Twand*, | 20 | 618. |
| 14. *Hew-lyang*, | 2 | 907. |
| 15. *Hew-tang*, | 4 | 903. |
| 16. *Hewtsin*, | 2 | 936. |
| 17. *Hew-han*, | 4 | 947. |
| 18. *Hew-chew*, | 3 | 951. |
| 19. *Song*, | 18 | 960. |
| 20. *Iwen*, | 9 | 1280. |
| 21. *Ming*, | 16 | 1368. |
| 22. *Tsing*, | | 1645. |

This table is formed according to the account of the Jesuit Du Halde, and is commonly reckoned to be the most authentic; but according to the abovementioned hypothesis of the compilers of the Universal History, who make *Yau* contemporary with Joshua, the dynasty of *Hya* did not commerce till the year before Christ 1057; and to accommodate the history to their hypothesis, great alterations must be made in the duration of the dynasties.

10 Incursions of the tartars.

The most interesting particulars of the Chinese history relate only to the incursions of the Tartars, who at last conquered the whole empire, and who still continue to hold the sovereignty; though by transferring the seat of the empire to Peking, and adopting the Chinese language, manners, *&c.* Tartary would seem rather to have been conquered by China, than China by Tartary. These incursions are said to have begun very early; even in the time of the emperor Shun, successor to Yau abovementioned, in whose reign the miraculous solstice happenned. At this time, the Tartars were repulsed, and obliged to retire into their own territories. From time to time, however, they continued to threaten the empire with invasions, and the northern provinces were often actually ravaged by the Tartars in the neighbourhood. About the year before Christ 213, Shi-whang-ti, having fully subdued all the princes, or kings, as they were called, of the different provinces, became emperor of China with unlimited power. He divided the whole empire into 36 provinces; and finding the northern part of his dominions much incommoded by the invasions of the neighbouring barbarians, he sent a formidable army against them, which drove them far beyond the boundaries of China.

11 Great wall built.

To prevent their return, he built the famous wall already mentioned, which separates China from Tartary. After this, being elated with his own exploits, he formed a design of making posterity believe that he himself had been the first Chinese emperor that ever sat on the throne. For this purpose, he ordered all the historical writings to be burnt, and caused many of the learned to be put to death, as already mentioned.

12 Kitan Tartars settle in China.

What effect the great wall for some time had in preventing the invasions of the Tartars, we are not told; but in the tenth century of the Christian aera, those of Kitan or Lyau got a footing in China. The Kitan were a people of eastern Tartary, who dwelt to the north and north-east of the province of Pecheli in China, particularly in that of Layu-tong lying without the great wall. These people having subdued the country between Korea and Kashgar, became much more troublesome to the Chinese than all the other Tartars. Their empire commenced about the year 916, in the fourth year of Mo-ti-kyan-ti, second emperor of the 14th Chinese dynasty called *Hew-lyang*. In 946, Mingt-song, second emperor of the 15th dynasty, being dead, Sheking-tang, his son-in-law, rebelled against Mingt-song, his son and successor, whom he deprived of his crown and life. This he accomplished by means of an army of 50,000 men furnished by the Kitan. Fi-ti, the son of Mingt-Song, being unable to resist the usurper, fled to the city Ghey-chew; where shutting himself up with his family and all his valuable effects, he set fire to the palace, and was burnt to ashes. On his death, Sheking-tang assumed the title of emperor; founded the 16th dynasty; and changed his name to that of *Kaut-su*. But the Kitan general refusing to acknowledge him, he was obliged to pur-

chase

China.

chase a peace by yielding up to the Tartars 16 cities in the province of Pecheli, besides a yearly present of 300,000 pieces of silk.

This submission served only to inflame the avarice and ambition of the Kitan. In 959, they broke the treaty when least expected, and invaded the empire afresh. Tsi-vang, the emperor at that time, opposed them with a formidable army: but through the treachery of his general Lyew-chi-ywen, the Tartars were allowed to take him prisoner. On this, Tsi-vang was glad to recover his liberty by accepting of a small principality; while the traitor became emperor of all China, and, changing his name to *Kaut-su*, founded the 17th dynasty. The Tartars, in the mean time, ravaged all the northern provinces without opposition, and then marched into the southern. But being here stopped by some bodies of Chinese troops, the general thought proper to retire with his booty into Tartary. In 962, Kaut-su, dying, was succeeded by his son In-ti. The youth of this prince gave an opportunity to the eunuchs to raise commotions; especially as the army was employed at a distance in repelling the invasions of the Tartars. This army was commanded by Ko-ghey, who defeated the enemy in several battles, and thus restored peace to the northern provinces. In the mean time, In-ti was slain by his eunuchs, and the empress placed his brother on the throne: but Ko-ghey, returning in triumph, was saluted emperor by his victorious army, and the empress being unable to support the rights of her son, was obliged to submit, while Ko-ghey, assuming the name of *Tay-tsu*, founded the 18th dynasty. Nine years after this, however, the grandees of the empire, setting aside Kong-ti, the third in succession from Tay-tsu, on account of his non-age, proclamed his guardian, named *Chau-quang-yu*, emperor; who assuming the name of Kau-tsu, founded the 19th dynasty, called *Song*, or *Tsong*.

Under this monarch the empire began to recover itself; but the Kitan still continued their incursions. The successors of Kau-tsu, opposed them with various success; but at last, in 978, the barbarians became so strong as to lay siege to a considerable city. Tay-tsong, successor to Kau-tsu, detached 3000 soldiers, each carrying a light in his hand, against them in the night-time, with orders to approach as near as possible to the Tartar camp. The barbarians imagining by the number of lights, that the whole Chinese army was at hand, immediately fled, and falling into the ambuscades laid for them by the Chinese general, were almost all cut to pieces.

This check, however, did not long put a stop to the ravages of the Kitan. In the year 999, they laid siege to a city in the province of Peche-li: but Ching-tsong, successor to Tay-tsong, came upon them with his army so suddenly, that they betook themselves to flight. The emperor was advised to take advantage of their consternation, and recover their country which had been yielded to them: but instead of pursuing his victory, he bought a peace, by consenting to pay annually 100,000 tael (about L.34,000), and 200,000 pieces of silk. The youth and pacific disposition of Jin-tsong, successor to Ching-tsong, revived the courage of the Kitan; and, in 1035, war would have been renewed, had not the emperor condescended to as shameful a treaty as that concluded by his father. Two years after, the Tartars demanded restitution of ten cities in the province of Peche-li, which had been taken by Ko-ghey founder of the 18th dynasty; upon which Jin-tsong engaged to pay them an annual tribute of 200,000 taels of silver, and 300,000 pieces of silk in lieu of these cities.

13 Kitan driven out by the eastern Tartars.

From this time the Kitan remained in peaceable possession of their Chinese dominions till the year 1117. Whey-tsong, at that time emperor, being able neither to bear their ravages, nor by himself to put a stop to them, resolved upon a remedy which at last proved worse than the disease. This was to call in the Nu-che, Nyu-che, or Eastern Tartars, to destroy the kingdom of the Kitan. From this he was dissuaded by the king of Korea, and most of his own ministers; but, disregarding their salutary advice, he joined his forces to those of the Nu-che. The Kitan were then every where defeated; and at last reduced to such extremity, that those who remained were forced to leave their country, and fly to the mountains of the west.

14 Who assume the name of *Kin*, and invade China.

Thus the empire of the Kitan was totally destroyed, but nothing to the advantage of the Chinese; for the Tartar general, elated with his conquest, gave the name of *Kin* to his new dominion, assumed the title of emperor, and began to think of aggrandizing himself and enlarging his empire. For this purpose, he immediately broke the treaties concluded with the Chinese emperor; and invading the provinces of Peche-li and Shen-si, made himself master of the greater part of them. Whey-tsong, finding himself in danger of losing his dominions, made several advantageous proposals to the Tartar; who, seeming to comply with them, invited him to come and settle matters by a personal conference. The Chinese monarch complied: but, on his return, the terms agreed on seemed intolerable to his ministers; so that they told him the treaty could not subsist, and that the most cruel war was preferable to such an ignominious peace. The Kin monarch, being informed of all that passed, had recourse to arms, and took several cities. Whey-tsong was weak enough to go in person to hold a second conference; but, on his arrival, was immediately seized by the Tartar. He was kept prisoner under a strong guard during the remaining part of his life; and ended his days in 1126, in the desert of Shamo, having nominated his eldest son Kin-tsong to succeed him.

15 They take the emperor prisoner.

Kin-tsong began his reign with putting to death six ministers of state, who had betrayed his father into the hands of the Kin Tartars. The barbarians in the mean time pursued their conquests without opposition. They crossed the Whang-ho, or Yellow River, which an handful of troops might have prevented; and marching directly towards the imperial city, took and plundered it. Then seizing the emperor and his consort, they carried them away captives: but many of the principal lords, and several of the ministers, preferring death to such an ignominious bondage, killed themselves. The Kin being informed by the empress *Meng* that she had been divorced, they left her behind. This proved the means of saving the empire:

16 Imperial city and another emperor taken.

for

China. for by her wisdom and prudence she got the crown placed on the head of Kau-tsong, ninth son of the emperor Whey-tsong by his divorced empress.

Kau-tsong fixed his court at Nanking the capital of Kyang-nan; but soon after was obliged to remove it to Kang-chew in Che-kyang. He made several efforts to recover some of his provinces from the Kin, but without effect. Hi-tsong the Kin monarch, in the mean time, endeavoured to gain the esteem of his Chinese-subjects by paying a regard to their learning and learned men, and honouring the memory of Confucius. Some time after, he advanced to Nanking, from whence Kau-tsong had retired, and took it: but, receiving advice that Yo-si, general of the Song, or southern Chinese, was advancing by long marches to

17 Progress the Kin checked. the relief of that city, they set fire to the palace, and retired northward. However, Yo-si arrived time enough to fall upon their rear-guard; which suffered very much; and from this time the Kin never dared to cross the river Kyang. In a few years afterwards the Chinese emperor submitted to become tributary to the Kin, and concluded a peace with them upon very dishonourable terms. This submission, however, was of little avail: for, in 1163, the Tartars broke the peace; and, invading the southern province with a formidable army, took the city of Yang-chew. The king, having approached the river Kyang, near its mouth, where it is widest as well as most rapid, commanded his troops to cross it, threatening with his drawn sword to kill those who refused. On receiving such an unreasonable command, the whole army mutinied; and the king being killed in the beginning of the tumult, the army immediately retired.

18 They are attacked by Jenghiz khan and the king of Hya. From this time to the year 1210, nothing remarkable occurs in the Chinese history; but this year, Jenghiz-khan, chief of the western Tartars, *Moguls*, or *Mungls*, quarrelled with Yong-tsi emperor of the Kin; and at the same time the king of Hya, disgusted at being refused assistance against Jenghiz-khan, threatened him with an invasion on the west side. Yong-tsi prepared for his defence; but in 1211, receiving news that Jenghiz-khan was advancing southward with his whole army, he was seized with fear, and made proposals of peace, which were rejected. In 1212, the

19 Great wall forced by Jenghiz-khan. Mogul generals forced the great wall; or, according to some writers, had one of the gates treacherously opened to them, to the north of Shansi; and made incursions as far as Peking the capital of the Kin empire. At the same time the province of Lyau-tong was almost totally reduced by several Kitan lords who had joined Jenghiz-khan; several strong places were taken, and an army of 300,000 Kin defeated by the Moguls. In autumn they laid siege to the city of Taytong-fu; where, although the governor Hujaku fled, yet Jenghiz-khan met with a considerable resistance. Having lost a vast number of men, and being himself wounded by an arrow, he was obliged to raise the siege and retire into Tartary; after which the Kin retook several cities. The next year, however, Jenghiz-khan re-entered China; retook the cities which the Kin had reduced the year before; and overthrew their armies in two bloody battles, in one of which the ground was strewed with dead bodies for upwards of four leagues.

The same year Yong-tsi was slain by his general Hujaku; and Sun, a prince of the blood, advanced in his room. After this the Moguls, attacking the empire with four armies at once, laid waste the provinces of Shansi, Honan, Pecheli, and Shantong. In 1214 Jenghiz-khan sat down before Peking; but instead of assaulting the city, offered terms of peace, which were accepted, and the Moguls retired into Tartary. After their departure, the emperor, leaving his son at Peking, removed his court to Pyen-lyang near Kay-fong-fu, the capital of Honan. At this Jenghiz-khan being offended, immediately sent troops to besiege Peking. The city held out to the fifth month of the year 1215, and then surrendered. At the same time the Moguls finished the conquest of Lyau-tong; and the Song refused to pay the usual tribute to the Kin. 20 Peking taken.

In 1216, Jenghiz-khan returned to pursue his conquests in the west of Asia, where he staid seven years; during which time his general Muhuli made great progress in China against the Kin emperor. He was greatly assisted by the motions of Ning-tsong emperor of the Song, or southern China; who, incensed by the frequent perfidies of the Kin, had declared war against them, and would hearken to no terms of peace, though very advantageous proposals were made. Notwithstanding this, however, in 1220, the Kin, exerting themselves raised two great armies, one in Shensi, and the other in Shang-ton. The former baffled the attempts of the Song and king of Hya, who had united against them; but the latter, though no fewer than 200,000, were entirely defeated by Muhuli. In 1221, that officer passed the Whang-ho, and died after conquering several cities. 21 Southern Chinese declared war against the Kin.

In 1224, the Kin emperor died; and was succeeded by his son Shew, who made peace with the king of Hya: but next year, that kingdom was entirely destroyed by Jenghiz-khan. In 1226, Oktay son to Jenghiz-khan marched into Honan, and besieged Kay-Song-fu, capital of the Kin empire; but was obliged to withdraw into Shensi, where he took several cities, and cut in pieces an army of 30,000 men. In 1227 Jenghiz-khan died, after having desired his sons to demand a passage for their army through the dominions of the Song, without which he said they could not easily vanquish the Kin. 22 Jenghiz-khan destroys the kingdom of Hya; 23 And dies.

After the death of that great conqueror, the war was carried on with various success; but though the Moguls took above 60 important posts in the province of Shensi, they found it impossible to force Tong-quan, which it behoved them to do in order to penetrate effectually into Honan. In April 1231 they took the capital of Shensi, and defeated the Kin army which came to its relief. Here one of the officers desired prince Toley to demand a passage from the Song through the country of Han-chong-fu. This proposal Toley communicated to his brother Oktay, who approved of it as being conformable to the dying advice of Jenghiz-khan. Hereupon Toley, having assembled all his forces, sent a messenger to the Song generals to demand passage through their territories. This, however, they not only refused, but put the messenger to death; which so enraged Toley that he swore to make them repent of it, and was soon as good as his word. He decamped in August 1231; and having forced the passages, put to the sword the inhabitants of 24 Moguls quarrel with the Song. 25 Exploits of Toley.

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Wha-yang and Fong-chew, two cities in the district of Han-chong-fu. Then having cut down rocks to fill up deep abysses, and made roads through places almost inaccessible, he came and besieged the city of Han-chong-fu itself. The miserable inhabitants fled to the mountains on his approach, and more than 100,000 of them perished. After this, Toley divided his forces, consisting of 30,000 horse, into two bodies. One of these went westward to Myen-chew: from thence, after opening the passages of the mountains, they arrived at the river Kyaling, which runs into the great Kyang. This they crossed on rafts made of the wood of demolished houses; and then, marching along its banks, seized many important posts. At last, having destroyed more than 140 cities, towns, or fortresses, they returned to the army. The second detachment seized an important post in the mountains, called *Tautong*, six or seven leagues to the eastward of Han-chong-fu. On the other side Oktay advanced, in October, towards Pu-chew a city of Shan-si; which being taken after a vigorous defence, he prepared to pass the Whang-ho. Toley, after surmounting incredible difficulties, arrived in December on the borders of Honan, and made a shew as if he designed to attack the capital of the Kin empire. On his first appearance in Honan through a passage so little suspected, every body was filled with terror and astonishment, so that he proceeded for some time without opposition. At last the emperor ordered his generals, Hota, Ilapua, and others, to march against the enemy. Toley boldly attacked them; but was obliged to retire, which he did in good order. Hota was for pursuing him, saying that the Mogul army did not exceed 30,000 men, and that they seemed not to have eaten any thing for two or three days. Ilapua, however, was of opinion that there was no occasion for being so hasty, as the Moguls were inclosed between the rivers Han and Whang-ho, so that they could not escape. This negligence they soon had occasion to repent of: for Toley, by a stratagem, made himself master of their heavy baggage; which accident obliged them to retire to Tang-chew. From thence they sent a messenger to acquaint the emperor that they had gained the battle, but concealed the loss of their baggage. This good news filled the court with joy; and the people who had retired into the capital for its defence, left it again, and went into the country; but, in a few days after, the vanguard of the Moguls, who had been sent by the emperor Oktay, appeared in the field, and carried off a great number of those that had quitted the city.

26
Capital of the Kin empire besieged.

In January 1232, Oktay passing the Whang-ho, encamped in the district of Kay-fong-fu, capital of the Kin empire, and sent his general Suputay to besiege the city. At that time the place was near 30 miles in circumference: but having only 40,000 soldiers to defend it, as many more from the neighbouring cities, and 20,000 peasants, were ordered into it; while the emperor published an affecting declaration, animating the people to defend it to the last extremity. Oktay, having heard with joy of Toley's entrance into Honan, ordered him to send succours to Suputay. On the other hand, the Kin generals advanced with 150,000 men to relieve the city; but being obliged to divide their forces in order to avoid in part the great road which Toley had obstructed with trees, they were attacked by that prince at a disadvantage, and, after a faint resistance, defeated with great slaughter, and the loss of both their generals, one killed and the other taken. The emperor now ordered the army at Tong-quan and other fortified places to march to the relief of Kay-fong-fu. They assembled accordingly, to the number of 110,000 foot and 15,000 horse; and were followed by vast numbers of people who expected by their means to be protected from the enemy. But many of these troops having deserted, and the rest being enfeebled by the fatigues of their march, they dispersed on the approach of their pursuers, who killed all they found in the highways. After this the Moguls took Tong-quan and some other considerable posts; but were obliged to raise the sieges of Quey-te-fu and Loyang, by the bravery of the governors. Kyang-shin, governor of Loyang, had only 3 or 4000 soldiers under him, while his enemies were 30,000 strong. He placed his worst soldiers on the walls, putting himself at the head of 400 brave men; whom he ordered to go naked, and whom he led to all dangerous attacks. He invented engines to cast large stones, which required but few hands to play them, and aimed so true as to hit at 100 paces distance. When their arrows failed, he cut those shot by the enemy into four pieces; pointed them with pieces of brass coin; and discharged them from wooden tubes with as much force as bullets are from a musket. Thus he harassed the Moguls for three months so grievously, that they were obliged, notwithstanding their numbers, to abandon the enterprize. 27

Bravery of the besieged.

Oktay, at last, notwithstanding his successes, resolved to return to Tartary; and offered the Kin emperor peace, provided he became tributary, and delivered up to him 27 families which he named. These offers were very agreeable to the emperor; but Suputay, taking no notice of the treaty, pushed on the siege of the capital with more vigour than ever. By the help of the Chinese slaves in his army, the Mogul general soon filled the ditch; but all his efforts seemed only to inspire the besieged with new vigour. The Moguls at that time made use of artillery, but were unable to make the least impression upon the city walls. They raised walls round those they besieged, which they fortified with ditches, towers, and battlements. They proceeded also to sap the walls of the city; but were very much annoyed by the artillery of the besieged, especially by their bombs, which sinking into the galleries, and bursting under ground, made great havock among the miners. For 16 days and nights the attack continued without intermission; during which time an incredible number of men perished on both sides: at length, Suputay, finding that he could 28
not take the city, withdrew his troops, under pretence of conferences being on foot. Soon after, the plague began in Kay-fong-fu; and raged with such violence, that in 50 days, 900,000 biers were carried out, besides a vast multitude of the poorer sort who could not afford any. 29

Peace concluded;

And broken.

In a short time, two unlucky accidents occasioned a renewal of the war; which now put an end to the empire of the Kin. Gan-yong, a young Mogul lord, having assumed the government of some cities in Kyang-nan, and killed the officer sent to take possession

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sion of them, declared for the Kin. The emperor unwarily took Gan-yong into his service, and gave him the title of Prince. Upon this Oktay sent an envoy, attended by 30 other persons, to inquire into the affair; but the Kin officers killed them all, without being punished by the emperor. Suputay, having informed his master of all these proceedings, was ordered to continue the war in Honan. Shew-fu now commanded his officers to unite their troops for the defence of the capital; but before his orders could be obeyed, they were attacked and defeated, one after another, by the Moguls. This obliged him to raise soldiers from among the peasants, for whose subsistence the people were taxed $\frac{3}{10}$ of the rice they possessed. The city began now to be distressed for want of provisions; and as it was but in a bad posture of defence, the emperor marched with an army against the Moguls. His expedition proved unfortunate; for, sending part of his army to besiege a city called Whychew, it was totally cut in pieces, and Suputay a second time sat down before the capital.

30 Capital again besieged,

31 And taken.

On hearing this bad news, the emperor repassed the Whang-ho, and retired to Quey-te-fu. Here he had not been long before the capital was delivered up by treachery, and Suputay put all the males of the imperial race to death; but, by the express command of Oktay, spared the inhabitants, who are said to have amounted to 1,400,000 families. After this disaster the unhappy monarch left his troops at Quey-te-fu, and retired to Juning-fu, a city in the southern part of Honan, attended only by 400 persons. Here the distance of the Moguls made him think of living at ease; but while he flattered himself with these vain hopes; the enemy's army arrived before the city and invested it. The garrison were terrified at their approach; but were encouraged by the emperor, and his brave general Hu-sye-hu, to hold out to the last. As there were not in the city a sufficient number of men, the women, dressed in mens clothes, were employed to carry wood, stones, and other necessary materials to the walls. All their efforts, however, were ineffectual. They were reduced to such extremities, that for three months they fed on human flesh; killing the old and feeble, as well as many prisoners, for food. This being known to the Moguls, they made a general assault in January 1234. The attack continued from morning till night: but at last the assailants were repulsed. In this action, however, the Kin lost all their best officers; upon which the emperor resigned the crown to Cheng-lin a prince of the blood. Next morning, while the ceremony of investing the new emperor was performing, the enemy mounted the south walls, which were defended only by 200 men; and the south gate being at the same time abandoned, the whole army broke in. They were opposed, however, by Hu-sye-hu; who, with 1000 soldiers, continued to fight with amazing intrepidity. In the mean time Shew-fu, seeing every thing irreparably lost, lodged the seal of the empire in a house; and then causing sheaves of straw to be set round it, ordered it to be set on fire as soon as he was dead. After giving this order he hanged himself, and his commands were executed by his domestics. Hu-sye-hu, who still continued fighting with great bravery, no sooner heard of the tragical death of the emperor than he drowned himself in the river Ju; as did also 500 of his most resolute soldiers. The same day the new emperor, Cheng-lin, was slain in a tumult; and thus an end was put to the dominion of the Kin Tartars in China.

32 Siege of Juning-fu.

33 Unhappy fate of the emperor.

34 Dissolution of the Kin empire.

The empire of China was now to be shared between the Song, or Southern Chinese, and the Moguls. It had been agreed upon, that the province of Honan should be delivered up to the Song as soon as the war was finished. But they, without waiting for the expiration of the term, or giving Oktay notice of their proceedings, introduced their troops into Kay-fong-fu, Lo-yang, and other considerable cities. On this the Mogul general resolved to attack them; and repassing the Whang-ho, cut in pieces part of the garrison of Lo-yang, while they were out in search of provisions. The garrison of Kay-fong-fu likewise abandoned that place; and the Song emperor degraded the officers who had been guilty of those irregularities, sending ambassadors to Otkay, at the same time, to desire a continuance of the peace. What Oktay's answer was we are not told, but the event showed that he was not well pleased; for, in 1235, he ordered his second son prince Kotovan, and his general Chahay, to attack the Song in Se-chwen, while others marched towards the borders of Kyang-nan.

35 War between the Song and the Moguls.

In 1236, the Moguls made great progress in the province of Hu-quang, where they took several cities, and put vast numbers to the sword. This year they introduced paper or silk money, which had formerly been used by Chang-tsong sixth emperor of the Kin. Prince Kotovan forced the passages into the district of Hang-chong-fu in the province of Shensi, which he entered with an army of 500,000 men. Here a terrible battle was fought between the vast army of the Moguls and the Chinese troops, who had been driven from the passages they defended. The latter consisted only of 10,000 horse and foot, who were almost entirely cut off; and the Moguls lost such a number of men, that the blood is said to have run for two leagues together. After this victory the Moguls entered Sechwen, which they almost entirely reduced, committing such barbarities, that, in one city, 40,000 people chose rather to put an end to their own lives than submit to such cruel conquerors.

36 Dreadful engagement.

In 1237, the Moguls received a considerable check before the city of Gan-tong in Kyang-nan, the siege of which they were obliged to raise with loss. In 1238 they besieged Lu-chew, another city in the same province. They surrounded it with a rampart of earth and a double ditch; but the Chinese general ordered their intrenchments to be filled with immense quantities of herbs steeped in oil, and then set on fire, while he shot stones upon them from a tower seven stories high. At the same time a vigorous sally was made; and the Mogul army being thrown into the utmost disorder, were obliged finally to abandon the siege and retire northwards.

In 1239, these barbarians were opposed by a general called Meng-kong, with great success; who, this and the following year, gained great honour by his exploits. While he lived, the Moguls were never able to make any considerable progress; but his death, in 1246, proved of the greatest detriment to the Chinese affairs; and soon after, the Tartars renewed the war with more vigour and success than ever. In

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1225, they re-entered the province of Se-chwen; but ſtill met with vigorous oppoſition in this quarter, becauſe the Chineſe took care to have Se-chwen furniſhed with good troops and generals. Though they were always beaten, being greatly inferior in number to their enemies, yet they generally retook the cities the Moguls had reduced, as the latter were commonly obliged to withdraw for want of proviſions and forage. In 1259 they undertook the ſiege of Ho-chew, a ſtrong city to the weſt of Peking, defended by Vang-kyen, a very able officer, who commanded a numerous garriſon. The ſiege continued from the month of February till Auguſt; during which time the Moguls loſt an immenſe number of men. On the 10th of Auguſt they made a general aſſault in the night. They mounted the walls before the governor had intelligence; but were ſoon attacked by him with the utmoſt fury. The Mogul emperor, Meng-ko, himſelf came to the ſcalade; but his preſence was not ſufficient to overcome the valour of Vang-kyen. At the ſame time the ſcaling-ladders of the Moguls were blown down by a ſtorm; upon which a terrible ſlaughter enſued, and among the reſt fell the emperor himſelf. Upon this diſaſter the Mogul generals agreed to raiſe the ſiege, and retire towards Shen-ſi.

37 Siege of Ho-chew.

38 Moguls defeated and their emperor killed.

On the death of Meng-ko, Hupilay, or Kublay Khan, who ſucceeded him, laid ſiege to Vu-chang-fu, a city not far diſtant from the capital of the Song empire.

At this the emperor being greatly alarmed, diſtributed immenſe ſums among his troops; and, having raiſed a formidable army, marched to the relief of Vu-chang-fu. Unfortunately the command of this army was committed to the care of Kya-tſe-tau, a man without either courage or experience in war. He was beſides very vain and vindictive in his temper; often uſing the beſt officers ill, and entirely overlooking their merit, which cauſed many of them to go over to the Moguls. The ſiege of Vu-chang-fu was commenced, and had continued a conſiderable time, when Kya-tſe-tau, afraid of its being loſt, and at the ſame time not daring to take any effectual ſtep for its relief, made propoſals of peace. A treaty was accordingly concluded, by which Kya-tſe-tau engaged to pay an annual tribute of about L.50,000 in ſilver, and as much in ſilk; acknowledging likewiſe the ſovereignty of the Moguls over the Song empire. In conſequence of this treaty, the Moguls retreated after the boundaries of the two empires had been fixed, and repaſſed the Kyang; but 170 of them having ſtaid on the other ſide of the river, were put to death by Kya-tſe-tau.

39 Treachery of a Chineſe miniſter.

This wicked miniſter totally concealed from the emperor his having made ſuch a ſhameful treaty with the Moguls; and the 170 ſoldiers maſſacred by his order, gave occaſion to report that the enemy had been defeated; ſo that the Song court believed that they had been compelled to retreat by the ſuperior valour and wiſdom of Kya-tſe-tau. This proved the ruin of the empire; for, in 1260, the Mogul emperor ſent Hauking to the Chineſe court to execute the treaty according to the terms agreed on with Kya-tſe-tau. The miniſter, dreading the arrival of this envoy, impriſoned him near Nanking; and took all poſſible care that neither Hupilay, nor Li-tſong the Chineſe emperor, ſhould ever hear any thing of him.

It was impoſſible ſuch unparalleled conduct could fail to produce a new war. Hupilay's courtiers inceſſantly preſſed him to revenge himſelf on the Song for their treacherous behaviour; and he ſoon publiſhed a manifeſto againſt them, which was followed by a renewal of hoſtilities in 1268. The Mogul army amounted to 300,000 men; but notwithſtanding their numbers, little progreſs was made till the year 1271. Syan-yang and Fan-ching, cities in the province of Se-chew had been beſieged for a long time ineffectually; but this year, an *Igur* lord adviſed Hupilay to ſend for ſeveral of thoſe engineers out of the weſt, who knew how to caſt ſtones of 150 pounds weight out of their engines, which made holes of ſeven or eight feet wide in the ſtrongeſt walls. Two of theſe engineers were accordingly ſent for; and after giving a ſpecimen of their art before Hupilay, were ſent to the army in 1272. In the beginning of 1273 they planted their engines againſt the city of Fan-ching, and preſently made a breach in the walls. After a bloody conflict the ſuburbs were taken; and ſoon after the Moguls made themſelves maſters of the walls and gates of the city. Nevertheleſs, a Chineſe officer, with only 100 ſoldiers, reſolved to fight from ſtreet to ſtreet. This he did for a long time with the greateſt obſtinacy, killing vaſt numbers of the Moguls; and both parties are ſaid to have been ſo much overcome with thirſt, that they drank human blood to quench it. The Chineſe ſet fire to the houſes, that the great beams, falling down, might embarraſs the way of their purſuers; but at laſt being quite wearied out, and filled with deſpair, they put an end to their own lives. After the taking of Fan-ching, all the materials which had ſerved at the ſiege were tranſported to Seyen-yang. The two engineers poſted themſelves againſt a wooden entrenchment raiſed on the ramparts. This they quickly demoliſhed: and the beſieged were ſo intimidated by the noiſe and havock made by the ſtones caſt from theſe terrible engines, that they immediately ſurrendered.

40 Deſperate conflict.

In 1274, Pe-yen, an officer of great valour, and endowed with many other good qualities, was promoted to the command of the Mogul army. His firſt exploits were the taking of two ſtrong cities; after which he paſſed the great river Ky-ang, defeated the Song army, and laid ſiege to Vu-chang-fu. This city was ſoon intimidated into a ſurrender; and Pe-yen, by reſtraining the barbarity of his ſoldiers, whom he would not allow to hurt any body, ſoon gained the hearts of the Chineſe ſo much, that ſeveral cities ſurrendered to him on the firſt ſummons. In the mean time the treacherous Kya-tſe-tau, who was ſent to oppoſe Pe-yen, was not aſhamed to propoſe peace on the terms he had formerly concluded with Hupilay; but theſe being rejected, he was obliged at length to come to an engagement. In this he was defeated, and Pe-yen continued his conqueſts with great rapidity. Having taken the city of Nanking, and ſome others, he marched towards Hang-chew-fu, the capital of the Song empire. Peace was now again propoſed, but rejected by the Mogul general; and at laſt the empreſs was conſtrained to put herſelf, with her ſon, then an infant, into the hands of Pe-yen, who immediately ſent them to Hupilay.

41 Chineſe empreſs ſubmits.

The ſubmiſſion of the empreſs did not yet put an end to the war. Many of the chief officers ſwore to

do

do their utmost to rescue her from the hands of her enemies. In consequence of this resolution they distributed their money among the soldiers, and soon got together an army of 40,000 men. This army attacked the city where the young emperor Kong-tsong was lodged, but without success; after which, and several other vain attempts, they raised one of his brothers to the throne, who then took upon him the name of Twon-tsong. He was but nine years of age when he was raised to the imperial dignity, and enjoyed it but a very short time. In 1277 he was in great danger of perishing, by reason of the ship on board which he then was being cast away. The poor prince fell into the water, and was taken up half dead with the fright. A great part of his troops perished at that time, and he soon after made offers of submission to Hupilay. These, however, were not accepted; for, in 1278, the unhappy Twon-tsong was obliged to retire into a little desert island on the coast of Quang-tong, where he died in the 11th year of his age.

42 Dissolution of the Song empire.

Notwithstanding the progress of the Moguls, vast territories still remained to be subdued before they could become masters of all the Chinese empire. On the death of Twon-tsong, therefore, the mandarins raised to the throne his brother, named Te-ping, at that time but eight years of age. His army consisted of no fewer than 200,000 men; but being utterly void of discipline, and entirely ignorant of the art of war, they were defeated by 20,000 Mogul troops. Nor was the fleet more successful; for being put in confusion by that of the Moguls, and the emperor in danger of falling into their hands, one of the officers taking him on his shoulders, jumped with him into the sea, where they were both drowned. Most of the mandarins followed this example, as did also the empress and minister, all the ladies and maids of honour, and multitudes of others, insomuch that 100,000 people are thought to have perished on that day. Thus ended the Chinese race of emperors; and the Mogul dynasty, known by the name of *Ywen*, commenced.

43 Reign of Hupilay.

Though no race of men that ever existed were more remarkable for cruelty and barbarity than the Moguls; yet it doth not appear that the emperors of the Ywen dynasty were in any respect worse than their predecessors. On the contrary, Hupilay, by the Chinese called *Shi-tsu*, found the way of reconciling the people to his government, and even of endearing himself to them so much, that the reign of his family is to this day styled by the Chinese *the wise government*. This he accomplished by keeping as close as possible to their ancient laws and customs, by his mild and just government, and by his regard for their learned men. He was indeed ashamed of the ignorance and barbarity of his Mogul subjects, when compared with the Chinese. The whole knowledge of the former was summed up in their skill in managing their arms and horses, being perfectly destitute of every art or science, or even of the knowledge of letters. In 1269, he had caused the Mogul characters to be contrived. In 1280, he caused some mathematicians search for the source of the river Whang-ho, which at that time was unknown to the Chinese themselves. In four months time they arrived in the country where it rises, and made a map of it, which they presented to his majesty. The same year a treatise on astronomy was published by his order; and, in 1282, he ordered the learned men to repair from all parts of the empire to examine the state of literature, and take measures for its advancement.

At his first accession to the crown he fixed his residence at Tay-ywen-fu, the capital of Shen-si; but thought proper afterwards to remove it to Peking. Here, being informed that the barks, which brought to court the tribute of the southern provinces, or carried on the trade of the empire, were obliged to come by sea, and often suffered shipwreck, he caused that celebrated canal to be made, which is at present one of the wonders of the Chinese empire, being 300 leagues in length. By this canal above 9,00 imperial barks transport with ease, and at small expence, the tribute of grain, rice, silks, *&c.* which is annually paid to the court. In the third year of his reign Shi-tsu formed a design of reducing the islands of Japan, and the kingdoms of Tonkquin and Cochin-china. Both these enterprises ended unfortunately, but the first remarkably so; for of 100,000 persons employed in it, only four or five escaped with the melancholy news of the destruction of the rest, who all perished by shipwreck. Shi-tsu reigned 15 years, died in the 80th year of his age, and was succeeded by his grandson. The throne continued in the Ywen family till the year 1367, when Shun-ti, the last of that dynasty, was driven out by a Chinese named Chu. During this period the Tartars had become enervated by long prosperity; and the Chinese had been roused into valour by their subjection. Shun-ti, the reigning prince, was quite sunk in sloth and debauchery; and the empire, besides, was oppressed by a wicked minister named Ama.

42 Moguls driven out.

45 Exploits of Chu.

In June 1355, Chu, a Chinese of mean extraction, and head of a small party, set out from How-chew, passed the Kyang, and took Tay ping. He then associated himself with some other malcontents, at the head of whom he reduced the town of Tu-chew, in Kyang-nan. Soon after he made himself master of Nanking, having defeated the Moguls who come to its relief. In December 1356, he was able to raise 100,000 men, at the head of whom he took the city of U-chew, in the east borders of Quang-si; and here, assembling his generals, it was resolved neither to commit slaughters nor to plunder. The most formidable enemy he had to deal with was *Chen-yew-lyang*, styled "emperor of the Han." This man being grieved at the progress made by Chu, equipped a fleet, and raised a formidable army, in order to reduce Nan-chang-fu, a city of Kyang-si, which his antagonist had made himself master of. The governor, however, found means to inform Chu of his danger; upon which that chief caused a fleet to be fitted out at Nanking, in which he embarked 200,000 soldiers. As soon as Chen-yew-lyang was informed of his enemy's approach, he raised the siege of Nan-chang-fu, and gave orders for attacking Chu's naval force. An engagement ensued between a part of the fleets, in which Chu proved victorious; and next day, all the squadrons having joined in order to come to a general engagement, Chu gained a second victory, and burnt 100 of the enemy's vessels. A third and fourth engagement happened, in both which Chu gained the victory; and in the

China. the last, Chen-yew-lyang himself was killed, his son taken prisoner, and his generals obliged to surrender themselves, with all their forces and vessels.

46 He is proclaimed king of U.

In January 1364, Chu's generals proposed to have him proclaimed emperor; but this he declined, and at first contented himself with the title of king of *U*. In February he made himself master of Vu-chang-fu, capital of Hu-quang; where, with his usual humanity, he relieved those in distress, encouraged the literati, and would allow his troops neither to plunder nor destroy. This wise conduct procured him an easy conquest both of Kyang-si and Hu-quang. The Chinese submitted to him in crowds, and professed the greatest veneration and respect for his person and government.

All this time Shun-ti, with an unaccountable negligence, never thought of exerting himself against Chu, but continued to employ his forces against the rebels who had taken up arms in various parts of the empire; so that Chu found himself in a condition to assume the title of emperor. This he chose to do at Nanking on the first day of the year 1368. After this his troops entered the province of Honan, which they presently reduced. In the third month, Chu, who had now taken the title of *Hong-vu*, or *Tay-tsu*, reduced the fortress of Tong-quan; after which his troops entered Pecheli from Honan on the one side, and Shan-tong on the other. Here his generals defeated and killed one of Shun-ti's officers; after which they took the city of Tong-chew, and then prepared to attack the capital, from which they were now but 12 miles distant. On their approach the emperor fled with all his family beyond the great wall, and thus put an end to the dynasty of Ywen. In 1370 he died, and was succeeded by his son, whom the successor of Hong-vu drove beyond the Kobi or Great Desert, which separates China from Tartary. They continued their incursions, however, for many years; nor did they cease their attempts till 1583, when vast numbers of them were cut in pieces by the Chinese troops.

47 Becomes emperor of China.

48 Moguls driven beyond the desert.

49 China again conquered by the Tartars.

The 21st dynasty of Chinese emperors, founded in 1368 by Chu, continued till the year 1644, when they were again expelled by the Tartars. The last Chinese emperor was named Whay-tsong, and ascended the throne in 1628. He was a great lover of the sciences, and a favourer of the Christians; though much addicted to the superstitions of the Bonzes. He found himself engaged in a war with the Tartars, and a number of rebels in different provinces. That he might more effectually suppress the latter, he resolved to make peace with the former; and for that end sent one of his generals, named *Ywen*, into Tartary, at the head of an army, with full power to negociate a peace; but that traitor made one upon such shameful terms, that the emperor refused to ratify it. Ywen, in order to oblige his master to comply with the terms made by himself, poisoned his best and most faithful general, named *Mau-ven-long*; and then desired the Tartars to march directly to Peking, by a road different from that which he took with his army. This they accordingly did, and laid siege to the capital. Ywen was ordered to come to its relief: but, on his arrival, was put to the torture and strangled; of which the Tartars were no sooner informed, than they raised the siege, and returned to their own country. In 1636, the rebels abovementioned composed four great armies, commanded by as many generals; which, however, were soon reduced to two, commanded by Li and Chang. These agreed to divide the empire between them; Chang taking the western provinces, and Li the eastern ones. The latter seized on part of Shen-si, and then of Honan, whose capital, named Kay-fong-fu, he laid siege to, but was repulsed with loss. He renewed it six months after, but without success; the besieged choosing rather to feed on human flesh than surrender. The imperial forces coming soon after to its assistance, the general made no doubt of being able to destroy the rebels at once, by breaking down the banks of the Yellow River; but unfortunately the rebels escaped to the mountains, while the city was quite overflowed, and 300,000 of the inhabitants perished.

After this disaster, Li marched into the provinces of Shen-si and Honan; where he put to death all the mandarins, exacted great sums from the officers in place, and showed no favour to any but the populace, whom he freed from all taxes: by this means he drew so many to his interest, that he thought himself strong enough to assume the title of emperor. He next advanced towards the capital, which, though well garrisoned, was divided into factions. Li had taken care to introduce before-hand a number of his men in disguise; and by these the gates were opened to him the third day after his arrival. He entered the city in triumph at the head of 300,000 men; whilst the emperor kept himself shut up in his palace, busied only with his superstitions. It was not long, however, before he found himself betrayed: and, under the greatest consternation, made an effort to get out of the palace, attended by about 600 of his guards. He was still more surprised to see himself treacherously abandoned by them, and deprived of all hopes of escaping the insults of his subjects. Upon this, preferring death to the disgrace of falling alive into their hands, he immediately retired with his empress, whom he tenderly loved, and the princess her daughter, into a private part of the garden. His grief was so great that he was not able to utter a word; but she soon understood his meaning, and, after a few silent embraces, hanged herself on a tree in a silking string. Her husband staid only to write these words on the border of his vest; "I have been basely deserted by my subjects; do what you will with me, but spare my people." He then cut off the young princess's head with one stroke of his scymitar, and hanged himself on another tree, in the 17th year of his reign, and 36th of his age. His prime minister, queens, and eunuchs, followed his example; and thus ended the Chinese monarchy, to give place to that of the Tartars, which hath continued ever since.

50 Unhappy fate of the emperor and his family.

It was some time before the body of the unfortunate monarch was found. At last it was brought before the rebel Li, and by him used with the utmost indignity; after which he caused two of Whey-tsong's sons, and all his ministers, to be beheaded; but his eldest son happily escaped by flight. The whole empire submitted peaceably to the usurper, except prince U-san-ghey, who commanded the imperial forces in the province of Lyau-tong. This brave prince, finding himself unable to cope with the usurper, invited the Tartars

Tartars to his aſſiſtance, and Tſong-te their king immediately joined him with an army of 80,000 men. Upon this the uſurper marched directly to Peking; but not thinking himſelf ſafe there, plundered and burnt the palace, and then fled with the immenſe treaſure he had got. What became of him afterwards we are not told; but the young Tartar monarch was immediately declared emperor of China, his father Tſong-te having died almoſt as ſoon as he ſet his foot in that empire.

The new emperor, named *Shun-chi*, or *Xun-chi*, began his reign with rewarding U-ſan-ghey, by conferring upon him the title of King; and aſſigned him the city of Si-gnan-fu, capital of Shen-ſi, for his reſidence. This, however, did not hinder U-ſan-ghey from repenting of his error in calling in the Tartars, or, as he himſelf uſed to phraſe it, in ſending for lions to drive away dogs." In 1674, he formed a very ſtrong alliance againſt them, and had probably prevailed if his allies had been faithful; but they treacherouſly deſerted him one after another: which ſo affected him, that he died ſoon after. In 1681 Hong-wha, ſon to U-ſan-ghey, who continued his efforts againſt the Tartars, was reduced to ſuch ſtraits that he put an end to his own life.

During this ſpace, there had been ſome reſiſtance made to the Tartars in many of the provinces. Two princes of Chineſe extraction had at different times been proclaimed emperors; but both of them were
51 Empire totally reduced.
overcome and put to death. In 1682, the whole 15 provinces were ſo effectually ſubdued, that the emperor Kang-hi, ſucceſſor to Shunc-hi, determined to viſit his native dominions of Tartary. He was accompanied by an army of 70,000 men, and continued for ſome months taking the diverſion of hunting. This he continued to do for ſome years; and in his journeys took father Verbeiſt along with him; by which means we have a better deſcription of theſe countries than could poſſibly have been otherwiſe obtained.
52 Chriſtianity firſt encouraged and then perſecuted.
This prince was a great encourager of learning and of the Chriſtian religion; in favour of which laſt he publiſhed a decree, dated in 1692. In 1716, however, he revived ſome obſolete laws againſt the Chriſtians; nor could the Jeſuits with all their art preſerve the footing they had got in China. The cauſes of this alteration in his reſolution are, by the miſſionaries, ſaid to have been the ſlanders of the mandarins: but, from the known character of the Jeſuits, it will be readily believed, that there was ſomething more at bottom. This emperor died in 1722, and was ſucceeded by his ſon Yon-ching; who not only gave no encouragement to the miſſionaries, but perſecuted all Chriſtians of whatever denomination, not excepting even thoſe of the imperial race. At the beginning of his reign he baniſhed all the Jeſuits into the city of Canton, and in 1732 they were baniſhed from thence into Ma-kau, a little iſland inhabited by the Portugueſe, but ſubject to China. He died in 1736; but though the Jeſuits entertained great hopes from his ſucceſſor, we have not heard that they have yet met with any ſucceſs.

Thus we have given an account of the moſt memorable tranſactions recorded in the Chineſe hiſtory. It now remains only to deſcribe the preſent ſtate of the empire and its inhabitants, according to the beſt and lateſt accounts.



The climate as well as the ſoil of this extenſive empire is very different in different parts; ſevere cold being often felt in the northern provinces, while the inhabitants of the ſouthern ones are ſcarce able to bear the heat. In general, however, the air is accounted wholeſome, and the inhabitants live to a great age.— 53 Climate, ſoil, and produce.
The northern and weſtern provinces have many mountains, which in the latter are cultivated, but in the north are barren, rocky, and incapable of improvement. On the mountains of Chenſi, Honan, Canton, and Fokien, are many foreſts, abounding with tall, ſtraight trees, of different kinds, fit for building, and particularly adapted for maſts and ſhip-timber. Theſe are uſed by the emperor in his private buildings; and from theſe foreſts enormous trunks are ſometimes tranſported to the diſtance of more than 300 leagues. Other mountains contain quickſilver, iron, tin, copper, gold, and ſilver. Formerly theſe laſt were not allowed to be opened, leſt the people ſhould thereby be induced to neglect the natural riches of the ſoil; and it is certain, that, in the 15th century, the emperor cauſed a mine of precious ſtones to be ſhut, which had been opened by a private perſon. Of late, however, the Chineſe are leſs ſcrupulous, and a great trade in gold is carried on by them. Many extravagant fables are told by the Chineſe of their mountains, particularly of one in Chen-ſi which throws out flames, and produces violent tempeſts, whenever any one beats a drum or plays on a muſical inſtrument near it. In the province of Folkien is a mountain, the whole of which is an idol, or ſtatue of the god Fo. This natural coloſſus, for it appears not to have been the work of art, is of ſuch an enormous ſize, that each of its eyes is ſeveral miles in circumference, and its noſe extends ſome leagues.

China has ſeveral large lakes; the principal one is that named Poyang-hou, in the province of Kiang-ſi. 54 Lakes and rivers.
It is formed by the confluence of four large rivers, extends near 100 leagues in length; and, like the ſea, its waters are raiſed into tempeſtuous waves. The empire is watered by an immenſe number of rivers of different ſizes, of which two are particularly celebrated, *viz.* the *Yang-tſe kiang*, or *ſon of the ſea*, and *Hoang-ho*, or the *Yellow river*. The former riſes in the province of Yun-nan, and paſſing through Hou-quang and Kiang-nan, falls into the eaſtern ocean, after a courſe of 1200 miles, oppoſite to the iſland of Tſon-ming, which is formed by the ſand accumulated at its mouth. This river is of immenſe ſize, being half a league broad at Nanking, which is near 100 miles from its mouth. The navigation is dangerous, ſo that great numbers of veſſels are loſt on it. It runs with a rapid current, forming ſeveral iſlands in its courſe, which are again carried off and new ones formed in different places, when the river is ſwelled by the torrents from the mountains. Theſe iſlands, while they remain, are very uſeful; producing great quantities of reeds ten or twelve feet high, which are uſed in all the neighbouring countries for fuel. The Hoang-ho, or yellow river, has its name from the yellow colour given it by the clay and ſand waſhed down in the time of of rain. It riſes in the mountains which border the province of Te-tchuen on the weſt, and after a courſe of near 600 leagues, diſcharges itſelf into the eaſtern ſea not far from the mouth of the Kiang. It is very broad and rapid, but ſo ſhallow that it is ſcarce navigable.

gable. It is very liable to inundations, often overflowing its banks, and deſtroying whole villages. For this reaſon it has been found neceſſary to confine it in ſeveral places by long and ſtrong dykes; which yet do not entirely anſwer the purpoſe. The people of Honan, therefore, whoſe land is exceedingly low, have ſurrounded moſt of their cities with ſtrong ramparts of earth faced with turf, at the diſtance of three furlongs.

55 Canals.

The Chineſe have been at great pains to turn their lakes and rivers to the advantage of commerce, by promoting an inland navigation. One of their principal works for this purpoſe, is the celebrated canal reaching from Canton to Peking, and forming a communication between the ſouthern and northern provinces. This canal extends through no leſs a ſpace than 600 leagues; but its navigation is interrupted in one place by a mountain, where paſſengers are obliged to travel 10 or 12 leagues over land. A number of other canals are met with in this and other provinces; moſt of which have been executed by the induſtry of the inhabitants of different cities and towns, in order to promote their communication with the various parts of the empire. M. Groſier remarks, that, in theſe works, the Chineſe have "ſurmounted obſtacles that perhaps would have diſcouraged any other people; ſuch, for example, is a part of a canal which conducts from *Chao-king* to *Ning-po*." Near theſe cities there are two canals, the waters of which do not communicate, and which differ ten or twelve feet in their level. To render this place paſſable for boats, the Chineſe have conſtructed a double glacis of large ſtones, or rather two inclined planes, which unite in an acute angle at their upper extremity, and extend on each ſide to the ſurface of the water. If the bark is in the lower canal, they puſh it up the plane of the firſt glacis by means of ſeveral capſtans, until it is raiſed to the angle, when by its own weight it glides down the ſecond glacis, and precipitates itſelf into the water of the higher canal with the velocity of an arrow. It is aſtoniſhing that theſe barks, which are generally very long and heavily loaden, never burſt aſunder when they are balanced on this acute angle; however, we never hear of any accident of this kind happening in the paſſage. It is true, they take the precaution of uſing for their keels a kind of wood which is exceedingly hard, and proper for reſiſting the violence of ſuch an effort.

56 Remarkable river, which partly ſinks under ground.

The following remarkable phenomenon in a Chineſe river is related by Father *le Couteux*, a French miſſionary. "Some leagues above the village Che-pai (ſays he), the river becomes conſiderably ſmaller, although none of its waters flow into any other channel; and, eight or nine leagues below, it reſumes its former breadth, without receiving any additional ſupply, excepting what it gets from a few ſmall rivulets, which are almoſt dry during the greater part of the year. Oppoſite to Che-pai it is ſo much diminiſhed, that, excepting one channel, which is not very broad, I have paſſed and repaſſed it ſeveral times by the help of a common pole. I was always ſurpriſed to find this river ſo narrow and ſhallow in that place; but I never thought of inquiring into the cauſe of it, until the loſs of a bark belonging to a Chriſtian family afforded me an opportunity. In that place where the river diminiſhes almoſt of a ſudden, it flows with great impetuoſity; and where it reſumes its former breadth it is equally rapid. At the ſixth moon, when the water was high and the wind ſtrong, the bark I have mentioned arriving above Che-pai, was driven on a ſand-bank; for between theſe two places the river is full of moveable ſands, which are continually ſhifting their ſituation. The maſter of the boat dropped his anchor until the wind ſhould abate, and permit him to continue his voyage; but a violent vortex of moveable ſand, which was caſt up from the bottom of the river, laid the bark on its ſide; a ſecond vortex ſucceeded; then a third; and afterwards a fourth, which ſhattered the bark to pieces. When I arrived at the place where this bark had been loſt, the weather was mild and ſerene; I perceived eddies in the current every where around; which abſorbed, and carried to the bottom of the river whatever floated on the ſurface; and I obſerved, at the ſame time, that the ſand was thrown violently up with a vortical motion. Above theſe eddies the water was rapid, but without any fall; and in the place below, where the river reſumes its uſual courſe, no eddies are to be ſeen, but the ſand is thrown up in the ſame violent manner; and in ſome places there are water-falls, and a kind of ſmall iſlands ſcattered at ſome diſtance from one another. Theſe iſlands which appear above the ſurface of the water, are not ſolid earth, but conſiſt of branches of trees, roots, and herbs collected together. I was told that theſe boughs roſe up from the water, and that no one knew the place from whence they came. I was informed, that theſe maſſes, which were 40 or 50 feet in extent on that ſide on which we paſſed, were immoveable, and fixed in the bottom of the river; that it was dangerous to approach them, becauſe the water formed whirlpools every where around them; that, however, when the river was very low, the fiſhermen ſometimes ventured to collect the buſhes that floated on its ſurface, and which they uſed for fuel. I am of opinion, that, at the place of the river which is above Che-pai, the water falls into deep pits, from whence it forces up the ſand with that vortical motion; and that it flows underground to the other place, eight or nine leagues below, where it carries with it all the boughs, weeds, and roots, which it waſhes down in its courſe, and thus forms thoſe iſlands which appear above its ſurface. We know there are ſome rivers that loſe themſelves entirely, or in part, in the bowels of the earth, and which afterwards ariſe in ſome other place; but I believe there never was one known to loſe part of its water below its own channel, and again to recover it at the diſtance of ſome leagues."

57 Why China is ſubject to famines, notwithſtanding its fertility.

It has already been ſaid, that China is, in general, a a fertile country; and indeed all travellers agree in this reſpect, and make encomiums on the extent and beauty of its plains. So careful are the huſbandmen of this empire to loſe none of their ground, that neither incloſure, hedge, nor ditch, nay, ſcarce a ſingle tree, are ever to be met with. In ſeveral places the land yields two crops a year; and even in the interval between the harveſts, the people ſow ſeveral kinds of pulſe and ſmall grain. The plains of the northern provinces yield wheat; thoſe of the ſouthern, rice, becauſe the country is low and covered with water. Notwithſtanding all this fertility, however, the inhabitants are much more frequently afflicted with famine than thoſe of the European nations, though the countries of Europe produce much leſs than China. For

this

China. this two causes are assigned. 1. The destruction of the rising corps by drought, hail, inundations, locusts, &c. in which case China cannot like the European countries be supplied by importation. This is evident by considering how it is situated with regard to other nations. On the north are the Mogul Tartars, a lazy and indolent race, who subsist principally on the flesh of their flocks; sowing only a little millet for their own use. The province of Leatong, which lies to the north-east, is indeed extremely fertile, but too far distant from the capital and centre of the empire to supply it with provisions; and besides, all carriage is impracticable but in the winter, when great quantities of game, and fish, preserved in ice, are sent thither. No corn is brought from Corea to China; and, though the Japan islands are only three or four days sailing from the Chinese provinces of Kiang-nan and Che-kyang, yet no attempt was ever made to obtain provisions from thence, whether it be, that the Japanese have nothing to spare, or on account of the insults offered by these islanders to foreign merchants. Formosa lies opposite to the province of Fo-kien; but so far is that island from being able to supply any thing, that in a time of scarcity it requires a supply from China itself. The province of Canton is also bounded by the sea, and has nothing on the south but islands and remote countries. One year, when rice was exceedingly scarce there, the emperor sent for F. Parranin, a Jesuit missionary, and asked him if the city of Macao could not furnish Canton with rice until the supply he had ordered from other provinces should arrive; but was informed that Macao had neither rice, corn, fruits, herbs, nor flocks; and that it generally got from China what was necessary for its subsistence.—The only method, therefore, the Chinese can take to guard against famines arising from these causes is to erect granaries and public magazines in every province and most of the principal cities of the empire. This has at all times been a principal object of care to the public ministers; but though this mode of relief still takes place in theory, so many ceremonies are to be gone through before any supply can be drawn from those public repositories, that it seldom arrives seasonably at the places where it is wanted; and thus numbers of unhappy wretches perish for want. 2. Another cause of the scarcity of grain in this empire, is the prodigious consumpt of it in the composition of wines, and a spirituous liquor called *rack*. But though government is well apprised that this is one of the principal sources of famine throughout the empire, it never employed means sufficient to prevent it. Proclamations indeed have frequently been issued, prohibiting the distillation of rack; and the appointed officers will visit the still-houses and destroy the furnaces if nothing is given them; but on slipping some money into their hands, they shut their eyes, and go somewhere else to receive another bribe. When the mandarin himself goes about, however, these distillers do not escape quite so easily, the workmen being whipped and imprisoned, after which they are obliged to carry a kind of collar called the *Cangue**; the masters are likewise obliged to change their habitations and conceal themselves for a short time, after which they generally resume their operations. It is impossible, however, that any method of this kind can prove effectual in suppressing these manufactories while the liquors themselves are allowed to be sold publicly; and against this there is no law throughout the empire. Our author, however, justly observes, that in case of a prohibition of this kind, the grandees would be obliged to deny themselves the use of these luxuries, which would be too great a sacrifice for the good of the empire.

*See below No. 74.

58 Immense population.

The population of China is so great, in comparison with that of the European countries, that the accounts of it have generally been treated as fabulous by the western nations; but by an accurate investigation of some Chinese records concerning the number of persons liable to taxation throughout the empire, M. Grosier has showed that it cannot be less than 200 millions. For this extraordinary population he assigns the following causes. 1. The strict obsevance of filial duty throughout the empire, and the prerogatives of fraternity, which make a son the most valuable property of a father. 2. The infamy attached to the memory of those who die without children. 3. The universal custom by which the marriage of children becomes the principal concern of the parents. 4. The honours bestowed by the state on those widows who do not marry a second time. 5. Frequent adoptions, which prevent families from becoming extinct. 6. The return of wealth to its original stock by the disinheriting of daughters. 7. The retirement of wives, which renders them more complaisant to their husbands, saves them from a number of accidents when big with child, and constrains them to employ themselves in the care of their children. 8. The marriage of soldiers. 9. The fixed state of taxes; which being always laid upon lands, never fall but indirectly on the trader and mechanic. 10. The small number of sailors and travellers. 11. To these may be added the great number of people who reside in China only by intervals; the profound peace which the empire enjoys; the frugal and laborious manner in which the great live; the little attention that is paid to the vain and ridiculous prejudice of marrying below one's rank; the ancient policy of giving distinction to men and not to families; by attaching nobility only to employments and talents, without suffering it to become hereditary. And, 12. lastly, A decency of public manners, and a total ignorance of scandalous intrigues and gallantry.

59 Unlimited authority of the emperor.

The government of China, according to the Abbe Grosier, is purely patriarchal. The emperor is more unlimited in his authority than any other potentate on earth; no sentence of death, pronounced by any of the tribunals can be executed without his consent, and every verdict in civil affairs is subject to be revised by him; nor can any determination be of force until it has been confirmed by the emperor: and, on the contrary, whatever sentence he passes is executed without delay; his edicts are respected throughout the empire as if they came from a divinity; he alone has the disposal of all offices, nor is there any such thing as the purchase of places in China; merit, real or supposed, raises to an office, and rank is attached to it only. Even the succession to the throne is not altogether hereditary. The emperor of China has a power of choosing his own successor without consulting any of of his nobility; and can ſelect one not only from among his own children, but even from the body of his people; and there have been ſeveral inſtances of his making uſe of this right: and he has even a power of altering the ſucceſſion after it has once been fixed, in caſe the perſon pitched upon does not behave towards him with proper reſpect. The emperor can alſo prevent the princes of the blood from exerciſing the title, with which, according to the conſtitution of the empire, they are inveſted. They may indeed, notwithſtanding this poſſeſs their hereditary dignity; in which caſe they are allowed a revenue proportioned to their high birth, as well as a palace, officers, and a court; but they have neither influence nor power, and their authority is lower than that of the meaneſt mandarin.

60 Mandarins of different claſſes.

The mandarins are of two claſſes, *viz.* thoſe of letters, and the inferior ſort, ſtyled mandarins of arms. The latter by no means enjoy the ſame conſideration with the former ſort; indeed in China the literati are highly honoured, and to their influence M. Groſier ſuppoſes that we may in a great meaſure aſcribe the mildneſs and equity of the government; though he thinks that the balance may incline rather too much in their favour. Several degrees, anſwering to thoſe of bachelor, licentiate, and doctor, muſt be paſſed through before one can attain to the dignity of a mandarin of letters; though ſometimes, by the favour of the emperor, it is conferred on thoſe who have attained only the two firſt degrees: but even the perſons who have gone through all the three, enjoy at firſt only the government of a city of the ſecond or third claſs. When ſeveral vacancies happen in the government of cities, the emperor invites to court a correſponding number of the literati, whoſe names are written down in a liſt. The names of the vacant governments are then put into a box, raiſed ſo high that the candidates are able only to reach it with their hands; after which they draw in their turns, and each is appointed governor of the city whoſe name he has drawn.

There are eight orders of theſe mandarins in China. 1. The *calao*, from whom are choſen the miniſters of ſtate, the preſidents of the ſupreme courts, and all the ſuperior officers among the militia. The chief of this order preſides alſo in the emperor's council, and enjoys a great ſhare of his confidence. 2. The *te-hioſe*, or man of acknowledged ability, is a title beſtowed upon every mandarin of the ſecond rank; and from theſe are ſelected the viceroys and preſidents of the ſupreme council in the different provinces. 3. The *tchong-tchueo*, or ſchool of mandarins, act as ſecretaries to the emperor. 4. *Y-tchuen,-tao.* Theſe keep in repair the harbours, royal lodging-houſes, and barks, which belong to the emperor, unleſs particularly engaged in ſome other office by his order. 5. The *ping-pi-tao* have the inſpection of the troops. 6. The *tun-tien-hao* have the care of the high-ways. 7. The *ho-tao* ſuperintend the rivers. 8. The *hai-tao* inſpect the ſea-coaſts.

Thus the whole adminiſtration of the Chineſe empire is intruſted to the mandarins of letters; and the homage paid by the common people to every mandarin in office, almoſt equals that paid to the emperor himſelf. This indeed flows from the nature of their government. In China it is a received opinion that the emperor is the father of the whole empire; that the governor of a province is the father of that province; and that the Mandarin who is governor of a city is alſo the father of that city. This idea is productive of the higheſt reſpect and ſubmiſſion, which is not at all leſſened by their great number; for though the mandarins of letters amount to more than 14,000, the ſame reſpect is paid to every one of them.

The mandarins of arms are never indulged with any ſhare in the government of the ſtate; however, to attain to this dignity, it is alſo neceſſary to paſs through the degrees of bachelor, licentiate, and doctor of arms. The accompliſhments neceſſary for a mandarin of arms are, ſtrength of body, with ability and readineſs in performing the various military exerciſes, and comprehending the orders requiſite for the profeſſion of arms: an examination on theſe ſubjects muſt be undergone before the candidate can obtain the wiſhed for dignity.

61 Tribunal of the mandarins of arms.

The mandarins of arms have tribunals, the members of which are ſelected from among their chiefs; and among theſe they reckon princes, counts, and dukes; for all theſe dignities, or ſomething equivalent to them, are met with in China. The principal of theſe tribunals is held at Peking, and conſiſts of five claſſes. 1. The mandarins of the rear-guard, called *heou-fou*. 2. Of the left wing, or *tſa-fou*. 3. Of the right wing, or *yeou-feou*. 4. Of the advanced main-guard, or *te-hong-fou*. 5. Of the advanced guard, or *tſien-fou*. Theſe five tribunals are ſubordinate to one named *iong-tching-fou;* the preſident of which is one of the great lords of the empire, whoſe authority extends over all the military men in the empire. By his high dignity he could render himſelf formidable even to the emperor; but to prevent this inconvenience, he has for his aſſeſſor a mandarin of letters, who enjoys the title and exerciſes the function of ſuperintendant of arms. He muſt alſo take the advice of two inſpectors who are named by the emperor; and when theſe four have agreed upon any meaſure, their reſolution muſt ſtill be ſubmitted to the reviſal of an higher court named *Ping-pou*, which is entirely of a civil nature. The chief of theſe mandarins is a general of courſe, whoſe powers are equivalent to thoſe of our commanders in chief; and below him are other mandarins who act as ſubordinate officers.

Theſe two claſſes of mandarins compoſe what is called the nobility of China; but as we have already hinted, their office is not hereditary; the emperor alone continues or confers it. They have the privilege of remonſtrating to the emperor, either as individuals or in a body, upon any part of his conduct which appears contrary to the intereſts of the empire. Theſe remonſtrances are ſeldom ill received, though the ſovereign complies with them only when he himſelf thinks proper. The number of literary mandarins in China is computed at upwards of 14,000; and thoſe of arms at 18,000; the former, however, are conſidered as the principal body in the empire; and this preference is thought to damp the military ardour of the nation in general, and to be one cauſe of that weakneſs in war for which the Chineſe are remarkable.

62 Military force.

The armies of this empire are proportioned to its vaſt extent and population; being computed in time of peace at more than 700,000. Their pay amounts to about twopence half-penny and a meaſure of rice per day, though ſome of them have double pay, and the pay of a horſeman is double that of a foot-ſoldier; the emperor furniſhes a horſe, and the horſeman receives two meaſures of ſmall beans for his daily ſubſiſtence; the arrears of the army being punctually paid up every three months.

The arms of a horſeman are, a helmet, cuiraſs, lance, and ſabre; thoſe of a foot-ſoldier are a pike and ſabre; ſome have fuſees, and others bows and arrows. All theſe are carefully inſpected at every review; and if any of them are found in the leaſt ruſted, or otherwiſe in bad condition, the poſſeſſor is inſtantly puniſhed; if a Chineſe, with 30 or 40 blows of a ſtick; or, if a Tartar, with as many laſhes.

63 Uſe of fire-arms loſt and revived.

Though the uſe of gun-powder is certainly very ancient in China, it appears to have been afterwards totally loſt, at leaſt fire-arms ſeem to have been almoſt entirely unknown ſome centuries ago. Three or four cannon were to be ſeen at that time about the gates of Nanking; but not a ſingle perſon in China knew how to make uſe of them; ſo that, in 1621, when the city of Macao made a preſent of three pieces of artillery to the emperor, it was found neceſſary alſo to ſend three men to load them. The utility of theſe weapons was quickly perceived by the execution which the three cannon did againſt the Tartars, at that time advanced as far as the great wall. When the invaders threatened to return, the mandarins of arms gave it as their opinion, that cannons were the beſt arms they could make uſe of againſt them. They were then taught the art of caſting cannon by F. Adam Schaal and Verbieſt, two Jeſuit miſſionaries, and their artillery was increaſed to the number of 320 pieces; at the ſame time that they were inſtructed in the method of fortifying towns, and conſtructing fortreſſes and other buildings according to the rules of modern architecture.

The beſt ſoldiers in China are procured from the three northern provinces, the others being ſeldom called forth, but allowed to remain at peace with their families: indeed there is not often occaſion for exerting their military talents, unleſs it be in the quelling of an inſurrection, when a mandarin or governor uſually accompanies them. They march in a very tumultuous manner, but want neither ſkill nor agility in performing their different evolutions. They, in general, handle a ſabre well, and ſhoot very dexterouſly with bows and arrows. There are in China more than 2000 places of arms; and through the different provinces there are diſperſed about 3000 towers or caſtles, all of them defended by garriſons. Soldiers continually mount guard there; and on the firſt appearance of tumult, the neareſt centinel makes a ſignal from the top of the tower, by hoiſting a flag in the day time, or lighting a torch in the night; when the neighbouring garriſons immediately repair to the place where their preſence is neceſſary.

64 Account of the great wall.

The principal defence of the empire againſt a foreign enemy is the great wall which ſeparates China from Tartary, extending more than 1500 miles in length, and of ſuch thickneſs that ſix horſeman may eaſily ride abreaſt upon it. It is flanked with towers two bow-ſhots diſtant from one another; and it is ſaid that a third of the able bodied men in the empire were employed in conſtructing it. The workmen were ordered, under pain of death, to place the materials ſo cloſely, that not the leaſt, entrance might be afforded for any inſtrument of iron; and thus the work was conſtructed with ſuch ſolidity, that it is ſtill almoſt entire, though 2000 years have elapſed ſince it was conſtructed. This extraordinary work is carried on not only through the low lands and valleys, but over hills and mountains; the height of one of which was computed by F. Verbieſt at 1236 feet above the level of the ſpot where he ſtood. According to F. Martini it begins at the gulf of Lea-tong, and reaches to the mountains near the city of Kin on the yellow river; between which places it meets with no interruption except to the north of the city of Suen in the province of Pecheli, where it is interrupted by a ridge of hedious and inacceſſible mountains, to which it is cloſely united. It is likewiſe interrupted by the river Hoang-ho; but for others of an inferior ſize, arches have been conſtructed, through which the water paſſes freely. Mr Bell informs us, that it is caracid acroſs rivers, and over the tops of the higheſt hills, without the leaſt interruption, keeping nearly along that circular range of barren rocks which incloſes the country; and, after running about 1200 miles, ends in impaſſable mountains and ſandy deſerts. The foundation conſiſts of large blocks of ſtone laid in mortar; but all the reſt is of brick. The whole is ſo ſtrong and well built, that it ſcarcely needs any repairs; and, in the dry climate in which it ſtands, may remain in the ſame condition for many ages. When carried over ſteep rocks, where no horſe can paſs, it is about 15 or 20 feet high: but when running through a valley, or croſſing a river, it is about 30 feet high, with ſquare towers and embraſures at equal diſtances. The top is flat, and paved with cut ſtone; and where it riſes over a rock or eminence, there is an aſcent made by an eaſy ſtone-ſtair. "This wall (our author adds) was begun and completely finiſhed in the ſhort ſpace of five years; and it is reported, that the labourers ſtood ſo cloſe for many miles, that they could hand the materials from one to another. This ſeems the more probable, as the rugged rocks among which it is built muſt have prevented all uſe of carriages; and neither clay for making bricks, nor any kind of cement, are to be found among them."

65 Courts by which the civil government is managed.

The whole civil government of China is managed by the following courts. 1. The emperor's grand council, compoſed of all the miniſters of ſtate, preſidents and aſſeſſors of the ſix ſovereign courts, and of three others, to be afterwards mentioned. This is never aſſembled but on affairs of the greateſt importance; the emperor's private council being ſubſtituted to it in all caſes of ſmaller moment. 2. The chief of the other courts furniſhes mandarins for the different provinces, watches over their conduct, and keeps a journal of their tranſactions, and informs the emperor of them, who rewards or puniſhes according to the report he gets.

This ſecond tribunal, which may be called a kind of civil inquiſition, is ſubdivided into four others; the firſt entruſted with the care of ſelecting thoſe who, on account of their learning or other good properties, are capable of filling the offices of government; the ſecond

 appointed

appointed to take care of the conduct of the mandarins; the third affixing the seals to the different public acts, giving the seals to mandarins, and examining those of the different dispatches; while the fourth enquires into the merit of the grandees of the empire, not excepting the princes of the imperial blood themselves. The principal sovereign court to which these four last are subordinate is called *Lii-pou*.

2. *Hou-pou*, or the grand treasurer, superintends all the finances of the state; is the guardian and protector of the treasures and dominions of the emperor, keeping an account of his revenues, *&c.* superintending the management and coining of money; the public magazines, custom-houses; and, lastly, keeping an exact register of all the families in the empire. To assist this court, 14 others are appointed throughout the different provinces of the empire.

3. *Li-pou*, or the court of ceremonies. "It is an undoubted fact (says M. Grosier), that ceremonies form, in part, the base of the Chinese government. This tribunal therefore takes care to support them, and enforce their observance; it inspects also the arts and sciences. It is consulted by the emperor when he designs to confer particular honours; takes care of the annual sacrifices offered up by him, and even regulates the entertainments which he gives either to strangers or his own subjects. It also receives and entertains foreign ambassadors, and preserves tranquillity among the different religious sects in the empire. It is assisted by four inferior tribunals.

4. *Ping-pou*, or the tribunal of arms, comprehends in its jurisdiction the whole militia of the empire; inspecting also the fortresses, magazines, arsenals, and store-houses of every kind, as well as the manufactories of arms both offensive and defensive; examining and appointing officers of every rank. It is composed entirely of mandarins of letters; and the four tribunals depending upon it consist also of literati."

5. The *hong-pou* is the criminal bench for the whole empire, and is assisted by 14 subordinate tribunals.

6. The *cong-pou*, or tribunal of public works, surveys and keeps in repair the emperor's palaces, as well as those of the princes and viceroys, and the buildings where the tribunals are held, with the temples, tombs of the sovereigns, and all public monuments. It has besides the superintendence of the streets, public highways, bridges, lakes, rivers, and every thing relating either to internal or foreign navigation. Four inferior tribunals assist in the discharge of these duties; the first drawing the plans of public works: the second directing the work-shops in the different cities of the empire; the third surveying the causeways, roads, bridges, canals, &c.; and the fourth taking care of the emperor's palaces, gardens, and orchards, and receiving their produce.

66
**Partiality of government towards the Chinese.**

All those tribunals are composed, one half of Chinese, and the other of Tartars; and one of the presidents of each superior tribunal is always a Tartar born. None of the courts above described, however, has absolute authority even in its own jurisdiction; nor can its decisions be carried into execution without the concurrence of another tribunal, and sometimes of several others. The fourth tribunal, for instance, has indeed under its jurisdiction the whole troops of the empire; but the payment of them is entrusted with the second, while the sixth has the care of the arms, tents, chariots, barks, and stores necessary for military operations; so that nothing relative to these can be put in execution without the concurrence of all the three tribunals.

67
**Censors.**

To prevent any lawful combination among the tribunals, each has its *censor* appointed. This is an officer whose duty is merely to watch over the proceedings of the court, without deciding upon any thing himself. He assists therefore at all assemblies, revises all their acts, and without acquainting the court in the least with either his sentiments or intentions, immediately informs the emperor of what he judges to be amiss. He likewise gives information of the behaviour of the mandarins, either in the public administration of affairs, or in their private conduct; nay, sometimes he will not scruple to reprimand the emperor for what he supposes to be erroneous in his conduct.

These censors are never removed from their places but in order to be promoted; and thus, holding their offices for life, they have the greater courage to speak out when they observe any impropriety or abuse. Their accusation is sufficient to set on foot an inquiry, which generally leads to a proof; in which case the accused is discharged from his office, and never held in any estimation afterwards. The complaints of the censors, however, are referred to the very tribunals against whose members they complain; though, being afraid of an accusation themselves, they very seldom pass sentence against the accusers.

Besides all this, the censors also form a tribunal of their own, named *tou-tche-yven*. Its members have a right of remonstrating with the emperor, whenever his own interest or that of the public renders it necessary. They inspect all lawyers and military men in public employments. "In short (says M. Grosier), they are, morally speaking, placed between the prince and the mandarins; between the mandarines and the people; between the people and families; between families and individuals; and they generally unite to the importance of their office incorruptible probity and invincible courage. The sovereign may, if he proceeds to rigour, take away their lives; but many of them have patiently suffered death, rather than betray the cause of truth, or wink at abuses. It is not sufficient therefore to have got rid of one, they must all be treated in the same manner; the last that might be spared would tread in the same steps with no less resolution than those who went before him. In the annals of no nation do we find an example of such a tribunal, yet it appears to be necessary in all, without exception. We must not, however, imagine, that the privileges of a censor gave him a right to forget his duty to his sovereign, or to communicate to the public those remarks which he takes the liberty of making to him: were he only to give the least hint of them to his colleagues, he would be punished with death; and he would share the same fate did he, in any of his representations, suffer a single word, inconsistent with moderation or respect, to escape him."

68
**Two courts peculiar to China.**

There are still two other courts in China, both of them peculiar to the empire, which deserve to be mentioned. The first is that of princes; and which, in conformity with its title, is composed of princes only.

In

In the registers of this tribunal are inscribed the names of all the children of the imperial family as soon as they are born; and to these are also consigned the dignities and titles which the emperor confers upon them. This is the only tribunal where the princes can be tried; and here they are absolved or punished according to the pleasure of the judges.

The other tribunal is that of history, called by the Chinese *han-lin-yvan*. It is composed of the greatest geniuses of the empire, and of men of the most profound erudition. These are entrusted with the education of the heir apparent to the throne, and the compilation and arrangement of the general history of the empire; which last part of their office renders them formidable even to the emperor himself. From this body the mandarins of the first class, and the presidents of the supreme class, are generally chosen.

69 Filial piety the basis of all their laws:

The basis of all the civil laws of the Chinese is filial piety. Every mandarin, who is a governor either of a province or city, must instruct the people assembled round him twice a month, and recommend to them the observance of certain salutary rules, which are summed up in a few short sentences, and such as no person can ever be supposed capable of forgetting.

70 Of their marriages.

The Chinese are allowed only to have one wife, whose rank and age must be nearly equal to that of their husbands; but they are allowed to have several concubines, whom they may admit into their houses without any formality, after paying the parents a sum of money, and entering into a written engagement to use their daughters well. These concubines, however, are all in subjection to the lawful wife; their children are considered as heirs; they address her as mother, and can give this title to her only. A person that has once been married, whether man or woman, may lawfully marry again, but it is then no longer necessary to study equality of age or condition. A man may choose his second wife from among his concubines; and, in all cases, this new marriage requires very few formalities. A widow is absolute mistress of herself, and can neither be compelled by her parents to marry again, nor to continue in a state of widowhood, contrary to her own inclination. Those of moderate rank, however, who have no children, do not enjoy the same privilege, as the parents of the former husband can dispose of her in marriage, not only without her consent, but without her knowledge. The law authorises the disposal of them in this manner, in order to indemnify the relations of the deceased husband for the money they may have cost him. If the wife is left big with child, this cannot take place, until she is delivered; nor can it be done at all if she brings forth a son. There are likewise two exceptions; 1. when the parents of the widow assign her a proper maintenance; and, 2. if the widow embraces a religious life, and becomes a bonzesse.

71 Divorces, unlawful marriages, &c.

Divorces are allowed in China in cases of adultery, mutual dislike, incompatibility of tempers, jealousy, &c. No husband, however, can put away or sell his wife until a divorce is legally obtained; and if this regulation be not strictly observed, the buyer and seller become equally culpable. If a wife, lawfully married, privately withdraws herself from her husband, he may immediately commence an action at law; by the sentence of which she becomes his slave, and he is at liberty to sell her to whom he pleases. On the other hand, if an husband leaves his wife for three years, she is at liberty, after laying her case before the mandarins, to take another husband; but if she were to anticipate their consent, she would be liable to a severe punishment.

Marriage is deemed illegal in China in the following cases. 1. If a young woman has been betrothed to a young man, and presents have been given and received by the parents of the intended husband and wife. 2. If in the room of a beautiful young woman another be substituted of a disagreeable figure; or if the daughter of a free man marry his slave; or if any one give his slave to a free woman, pretending to her parents that he is his son or relation. In all these cases the marriage is null and void; and all those who have had any share in making up the match are severely punished.

3. Any mandarin of letters is forbidden to form an alliance with any family residing in the province or city of which he is governor.

4. No Chinese youth can enter into a state of marriage during the time of mourning for his father or mother; and if promises have been made before, they cease immediately on that event taking place. After the usual time of mourning is expired, however, the parents of the intended bride are obliged to write to those of the young man, putting him in mind of his engagement.

5. Marriage is also suspended when a family experiences any severe misfortune, and even if a near relation were thrown into prison; though this may be set aside, provided the unfortunate person give his consent.

6. Two brothers cannot marry two sisters; nor is a widower at liberty to marry his son to the daughter of a widow whom he chooses for his own wife. A man is also forbidden to marry any of his own relations, however distant the degree of consanguinity may be between them.

In China every father of a family is responsible for the conduct of his children, and even of his domestics; all those faults being imputed to him which it was his duty to have prevented. Every father has the power of selling his son, "provided (says the law) the son has a right of selling himself." This custom, however, is barely tolerated among the middling and inferior ranks; and all are forbidden to sell them to comedians, or people of infamous character, or very mean stations.

In China a son remains a minor during the whole lifetime, and is even liable for the debts contracted by his father, those from gaming only excepted. Adoption is authorised by law, and the adopted child immediately enters into all the rights of a lawful son; only the law gives a right to the father of making a few dispositions in favour of his real children. The children, however, whether adopted or not, cannot succeed to the dignity or titles of their father, though they may to his estate. The emperor alone can confer honours; and even then they must be resigned when the person attains the age of 70; though this resignation is considered as an advice rather than a law.

China. law. The will of a father cannot be set aside in China on account of any informality; nor can any mother in this empire make a will.

Though the Chinese laws authorise slavery, yet the power of the master extends only to those matters which concern his own service; and he would be punished with death for taking advantage of his power to debauch the wife of his slave.

By the laws of China husbandmen are exempt from the payment of taxes after they have begun to till the earth to the beginning of harvest.

72
Criminal laws in China.

In criminal matters every person accused must be examined before five or six tribunals; and whose enquiries are directed not only against him, but against his accuser, and the witnesses that appear in the cause. He is, however, obliged to remain in prison during the process: "but (says M. Grosier) the Chinese prisons are not horrible dungeons like those of so many other nations; they are spacious, and have even a degree of convenience. One of the mandarins is obliged to inspect them frequently; and this he does with the greater punctuality, as he must answer for those who are sick. He is obliged to see them properly treated, to send for physicians, and to supply them with medicines at the emperor's expence. If any of them dies, he must inform the emperor, who perhaps will order some of the higher mandarins to examine whether the former has discharged his duty faithfully or not.

73
Method of inflicting the bastinado.

The slightest punishment in China is the bastinado; and the number of blows is to be determined by the degree of the offender's guilt. Twenty is the lowest number; and in this case the punishment is considered as having nothing infamous in it, but being only a simple paternal correction. In this way the emperor sometimes orders it to be inflicted on his courtiers; which does not prevent them from being afterwards received into favour, and as much respected as before. Every mandarin may inflict the bastinado when any one forgets to salute him, or when he sits in judgment in public. The instrument of correction is called *pan-tsee*, and is a piece of bamboo a little flatted, broad at the bottom, and polished at the upper extremity, in order to manage it more easily with the hand. When the punishment is to be inflicted, the magistrate sits gravely behind a table, having on it a bag filled with small sticks, while a number of petty officers stand around him, each furnished with these *pan-tsees*, and waiting only for his signal to make use of them. The mandarin then takes out one of the little sticks contained in the bag, and throws it into the hall of audience. On this the culprit is seized and stretched out with his belly towards the ground; his breeches are pulled down to his heels, and an athletic domestic applies five smart blows with his *pan-tsee*. If the judge draws another small stick from the bag, another officer succeeds, and bestows five more blows; and so on until the judge makes no more signals. When the punishment is over, the criminal must throw himself on his knees, incline his body three times to the earth, and thank the judge for the care he takes of his education.

For faults of a higher nature, the carrying of a wooden collar, called by the Portuguese the *cangue*, is inflicted. This machine is composed of two pieces of wood hollowed out in the middle, which, when put together, leave sufficient room for the neck. These are laid upon the shoulders of the criminal, and joined together in such a manner, that he can neither see his feet nor put his hands to his mouth; so that he is incapable of eating without the assistance of another. This disagreeable burden he is obliged to carry day and night; its weight is from 50 to 200 pounds, according to the enormity of the crime, to which the time of carrying it is also proportioned. For robbery, breaking the peace, or disturbing a family, or being a notorious gambler, it is generally carried three months. During all this time the criminal is not allowed to take shelter in his own house, but is stationed for a certain space of time, either in some public square, the gate of a city or temple, or perhaps even of the tribunal where he was condemned. On the expiration of his term of punishment, he is again brought before the judge, who exhorts him in a friendly manner to amend; and after giving him 20 sound blows discharges him.

74
The *cangue*, or wooden collar.

75
Banishment. &c.

Banishment is infliction for crimes of a nature inferior to homicide, and the duration is often for life, if the criminals be sent into Tartary. Some culprits are condemned to drag the royal barks for three years, or to be branded in the cheeks with a hot iron, indicating the nature of their transgressions. Robbery between relations is more severely punished than any other; and that is accounted the most atrocious where younger brothers or nephews appropriate to themselves beforehand any part of the succession in which they have a right to share with their elder brothers or nephews.

76
Punishment of informers against parents, &c.

Information against a father or mother, grandfather or grandmother, uncle or eldest brother, even though the accusation be just, is punished with 100 blows of the pan-tsee, and three years banishment. If the accusation be false, it is punished with death. Deficiency in proper filial respect to a father, mother, grandfather, or grandmother, is punished with 100 blows of the pan-tsee; abusive language to these relations is death by strangling; to strike them is punished by beheading; and if any one presumes to hurt or maim them, his flesh is torn from his bones with red hot pincers, and he is cut into 1000 pieces. Abusing an elder brother is punished with 100 blows of the pan-tsee; striking him, with the punishment of exile.

77
Capital punishments, how inflicted.

Homicide, even though accidental, is punished with death in China. A rope about six or seven feet in length, with a running noose, is thrown over the criminal's head; and a couple of domestics belonging to the tribunal pull it strongly in different directions. They then suddenly quit it, and in a few moments give a second pull; a third is seldom necessary to finish the business. Beheading is accounted in China the most dishonourable of all punishments, and is reserved only for desperate assassins, or those who commit some crime equally atrocious with murder. To be cut in a thousand pieces is a punishment inflicted only upon state criminals or rebellious subjects. It is performed by tying the criminal to a post, scalping the skin from the head, and pulling it over the eyes. The executioner then tears the flesh from different parts of the

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unhappy wretch's body; and never quits this horrible employment till mere fatigue obliges him to give over: the remains of the body are then left to the barbarous ſpectators, who finiſh what he has begun. Though this puniſhment, however, has been inflicted by ſome emperors with all the dreadful circumſtances juſt mentioned, the law orders only the criminal's belly to be opened, his body to be cut into ſeveral peices, and then thrown into a ditch or river.

The torture, both ordinary and extraordinary, is uſed in China. The former is applied to the hands or feet: for the hands, ſmall pieces of wood are applied diagonally between the fingers of the criminal; his fingers are then tied cloſe with cords, and he is left for ſome time in that painful ſituation. The torture for the feet is ſtill worſe. An inſtrument, conſiſting of three croſs pieces of wood, is provided, that in the middle being fixed, the others moveable. The feet of the criminal are then put into this machine, which ſqueezes them ſo cloſe that the ancle bones become flat. The extraordinary torture conſiſts in making ſmall gaſhes in the body, and then tearing off the ſkin like thongs. It is never applied but for ſome great crime, ſuch as treaſon, or where the criminal's guilt has been clearly proved, and it is neceſſary to make him diſcover his accomplices.

78 M. Groſier's general view of the Chineſe laws.

Notwithſtanding thoſe dreadful puniſhments, M. Groſier is at great pains to prove that the laws of the Chineſe, with regard to criminal matters, are extremely mild. "One law (ſays he) will no doubt appear exceedingly ſevere and rigorous; it inflicts the puniſhment of death on thoſe who uſe pearls. Thoſe who read the hiſtory of China will be apt to fall into certain miſtakes reſpecting the penal laws of that nation. Some of its ſovereigns have indulged themſelves in gratifying ſanguinary caprices which were not authoriſed by the laws, and which have often been confounded with them: but theſe princes are even yet ranked among the number of tyrants, and their names are ſtill abhorred and deteſted throughout the whole empire. The Chineſe, in their criminal procedure, have a great advantage over all other nations: it is almoſt impoſſible that an innocent man ſhould ever become a victim to a falſe accuſation: in ſuch caſes the accuſer and witneſs are expoſed to too much danger. The ſlowneſs of the proceſs, and the numberleſs reviſions it undergoes, are another ſafeguard for the accuſed. In ſhort, no ſentence of death is ever carried into execution until it has been approved and confirmed by the emperor. A fair copy of the whole proceſs is laid before him; a number of other copies are alſo made out, both in the Chineſe and Tartar languages, which the emperor ſubmits to the examination of a like number of doctors, either Tartars or Chineſe. When the crime is of great enormity, and clearly proved, the emperor writes with his own hand at the bottom of the ſentence, "When you receive this order, let it be executed without delay." In caſes where the crime, though puniſhable by death according to law, is ranked in the ordinary claſs, the emperor writes at the bottom of the ſentence, "Let the criminal be detained in priſon, and executed in autumn;" that being the ſeaſon in which they are generally executed, and all on the ſame day.

The emperor of China never ſigns an order for the execution of a criminal till he has prepared himſelf by faſting. Like other monarchs he has the power of giving pardons; but in this reſpect is much more limited than any other. The only caſes in which the Chineſe monarch can remit the puniſhment inflicted by law, are, 1. To the ſon of a widow who has not married again; 2. To the heir of an ancient family; 3. The deſcendents of great men or citizens who have deſerved well of their country; and, 4. laſtly, the ſons, or grandſons of a mandarin, who has become illuſtrious, and diſtinguiſhed himſelf by faithfully diſcharging the duties of his office. Neither a child, nor a man of very advanced age, can be cited before a tribunal. The ſon of a very aged father and mother is pardoned, if private property or the public peace be not hurt by giving him a pardon; and if the ſons of ſuch a father and mother be all guilty, or accomplices in the ſame crime, the youngeſt is pardoned in order to comfort his parents.

79 Caſes in which crimes may be pardoned.

In China the accuſed are always treated with tenderneſs and lenity, being accounted innocent until their guilt be clearly proved; and even then, liberty excepted, they are ſcarce allowed to want for any thing. A jailor is puniſhed who behaves rigorouſly towards his priſoners; and the judges muſt likewiſe anſwer at their peril for any additions to the ſeverity of the law: depoſition being the ſlighteſt puniſhment inflicted upon them.

Subſtitution is ſometimes allowed by the laws of China; ſo that the near relation of a guilty perſon may put himſelf into the criminal's place, provided, however, that the chaſtiſement be ſlight, and the accuſed his ancient friend. The ſons, grandſons, wife, and brothers of a baniſhed Chineſe, are allowed to follow him into exile; and the relations of all perſons are permitted to viſit them in priſon, and to give them every aſſiſtance in their power; to do which good offices they are even encouraged, inſtead of being prevented.

80 Of the cities and their government.

Every city in China is divided into different quarters, each of which is ſubjected to the inſpection of a certain officer, who is anſwerable for whatever paſſes in the place under his juriſdiction. Fathers of families, as we have already obſerved, are anſwerable for the conduct of their children and domeſtics. Neighbours are even obliged to anſwer for one another, and are bound to give every help and aſſiſtance in caſes of robery, fire, or any accident, eſpecially in the night-time. All the cities are furniſhed with gates, which are barricaded on the commencement of night. Centinels are alſo poſted at certain diſtances throughout the ſtreets, who ſtop all who walk in the night, and a number of horſemen go round the ramparts for the ſame purpoſe; ſo that it is almoſt impoſſible to elude their vigilance by favour of the darkneſs. A ſtrict watch is alſo kept during the day time; and all thoſe who give any ſuſpicion by their looks, accent, or behaviour, are immediately carried before a madarin, and ſometimes even detained until the pleaſure of the governor be known.

Private quarrels do not often happen in China, and it is rare that they are attended with a fatal iſſue. The champions ſometime decide the quarrel with their fiſts, but moſt frequently refer the caſe to a mandarin, who very often orders them both a ſound drubbing

China.

bing. None but military people are permitted to wear arms in public; and this privilege is extended even to them only during the time of war, or when they accompany a mandarin, mount guard, or attend a review. Prostitutes are not allowed to remain within the walls of a city, or to keep a house of their own even in the suburbs. They may, however, lodge in the house of another: but that other is accountable for every disturbance which may happen on their account.

81 Borrowing of money.

In all the Chinese cities, and even in some of their ordinary towns, there is an office where money may be borrowed upon pledges at the common rate of the country; which, however, is no less than 30 *per cent.* Every pledge is marked with a number when left at the office, and must be produced when demanded; but it becomes the property of the office if left there a single day longer than the term agreed upon for the payment of the money. The whole transaction remains an inviolable secret; not even the name of the person who leaves the pledge being inquired after.

82 Of the Chinese roads.

Great attention is paid by the administration of China to the conveniency of travellers. The roads are generally very broad, all of them paved in the southern provinces, and some in the northern; but neither horses nor carriages are allowed to pass along these. In many places valleys have been filled up, and rocks and mountains cut through, for the purpose of making commodious high ways, and to preserve them as nearly as possible on a level. They are generally bordered with very lofty trees, and in some places with walls eight or ten feet high, to prevent travellers from going into the fields; but openings are left in proper places, which give a passage into cross roads that lead to different villages. Covered seats are erected on all the great roads, where travellers may shelter themselves from the inclemency of the weather; temples and pagods are also frequent, into which travellers are admitted without scruple in the day-time, but often meet with a refusal in the night. In these mandarins only have a right to rest themselves as long as they think proper. There is, however, no want of inns on the great roads, or even the cross ones in China; but they are ill supplied with provisions: and those who frequent them are even obliged to carry beds along with them to sleep on, or else take up with a plain mat.

Towers are erected on all the roads of this great empire, with watch-boxes on the top, with flag-staffs, for the convenience of signals, in case of any alarm. These towers are square, and generally constructed of brick, but seldom exceed twelve feet in height. They are built, however, in sight of one another, and are guarded by soldiers, who run with great speed from one to another, carrying letters which concern the emperor. Intelligence of any remarkable event is also conveyed by signals; and thus the court is informed with surprising quickness of any important matter. Those which are built on any of the roads conducting to court, are furnished with battlements, and have also very large bells of cast iron. According to law these towers should be only five *lys*, about half a French league, distant from one another.

83 Method of conveyance.

There is no public post-office in China, though several private ones have been established; but the couriers and offices charged with dispatches for the empire have only a right to make use of them. This inconvenience, however excepted, travellers find conveyance very easy from one part of China to another. Great numbers of porters are employed in every city, all of whom are associated under the conduct of a chief, who regulates all their engagements, fixes the price of their labour, receives their hire, and is responsible for every thing they carry. When porters are wanted, he furnishes as many as may be necessary, and gives the same number of tickets to the traveller; who returns one to each porter when they have conveyed their loads to an appointed place. These tickets are carried back to the chief, who immediately pays them from the money he received in advance. On all the great roads in China there are several offices of this kind, which have a settled correspondence with others; the travellers therefore have only to carry to one of these offices a list of such things as they wish to have transported: this is immediately written down in a book; and though there should be occasion for two, three, or four hundred porters, they are instantly furnished. Every thing is weighed before the eyes of their chief, and the hire is five pence per hundred weight for one day's carriage. An exact register of every thing is kept in the office; the traveller pays the money in advance, after which he has no occasion to give himself any farther trouble: on his arrival at the city he designs, his baggage is found at the corresponding office, and every thing is delivered to him with the most scrupulous exactness.

84 Custom-houses.

The custom-houses are here regulated by the general police of the country; and according to M. Grosier's account, these custom-house officers are the most civil in the world. They have no concern with any class of people but the merchants, whom they take care not to distress by any rigorous exactions; neither, though they have authority to do so, do they stop travellers till their baggage is examined, nor do they even require the smallest fee from them. Duties are paid either by the piece or the load; and in the former case credit is given to the merchant's book without asking any questions. A mandarin is appointed by the viceroy of each province to inspect the custom-houses of the whole district; and the mandarins have also the care of the post-offices.

85 Money of the empire.

In former times the only money used in China was made of small shells, but now both silver and copper coin are met with. The latter consists of round pieces about nine-tenths of an inch (A) in diameter, with a small square hole in the middle, inscribed with two Chinese words on one side, and two Tartar ones on the other. The silver pieces are valued only by their weight. For the convenience of commerce, the metal is therefore cast into plates of different sizes; and for want of small coin, a Chinese always carries about

(A) The Chinese foot is longer by one hundredth part than the French, and the inch is divided into ten parts.

about him his scales, weights, and a pair of scissars to cut the metal. This operation is performed by putting the silver between the scissars, and then knocking them against a stone till the pieces drop off. In giving of change, however, people have no right to value silver by the numerical value of copper, this being entirely regulated by the intrinsic value of the metals. Thus, an ounce of silver will sometimes be worth 1000 copper pieces, and sometimes only 800; and thus the copper money of China may frequently be sold for more than it would pass for in commerce. The emperor would lose much by this recoinage, were he not the sole proprietor of all the copper mines in China. It is, however, expresly forbidden to employ copper coin in any manufacture where it might be employed as plain copper, and it is also forbidden to be sold for the purpose of melting: but, if the price of the metal has not fallen, the infraction of this law is not very severely punished. On the other hand, if the value of unwrought copper exceeds that of the coin, a quantity of the latter is issued out to restore the equilibrium.

To keep up a constant circulation of all the coin in the empire, the Chinese government are attentive to preserve an equilibrium between the proportional value of the gold and silver; that is, to regulate the intrinsic value of each in such a manner that the possessor of silver may not be afraid to exchange it for copper, nor the possessor of copper for silver. The method used for this purpose is, when silver becomes scarce, to make all the payments for some time in silver; but if copper, to make them all for some time in that metal only.

86

Of the Chinese commerce.

The commerce of China is under the inspection of the tribunal of finances; but on this subject the Chinese entertain an opinion quite different from that of the Europeans. Commerce, according to them, is only useful as far as it eases the people of their superfluities, and procures them necessaries. For this reason they consider even that which is carried on at Canton as prejudicial to the interest of the empire. "They take from us (say the Chinese) our silks, teas, and porcelain: the price of these articles is raised through all the provinces: such a trade therefore cannot be beneficial. The money brought us by Europeans, and the high-priced baubles that accompany it, are mere superfluities to such a state as ours. We have no occasion for more bullion than what may be necessary to answer the exigencies of government, and to supply the relative wants of individuals. It was said by Kouan-tse, two thousand years ago, That the money introduced does not enrich a kingdom in any other way than as it is introduced by commerce. No commerce can be advantageous long, but that which consists in a mutual exchange of things necessary or useful. That trade, whether carried on by barter or money, which has for its object the importing of articles that tend to the gratification of pride, luxury, or curiosity, always supposes the existence of luxury: but luxury, which is an abundance of superfluities among certain classes of people, supposes the want of necessaries among a great many others. The more horses the rich put to their carriages, the greater will be the number of those who are obliged to walk on foot; the larger and more magnificent their houses are, so much the more confined and wretched must those of the poor be; and the more their tables are covered with a variety of dishes, the more must the number of those increase who are reduced to the necessity of feeding upon plain rice. Men, united by society in a large and populous kingdom, can employ their industry, talents, and economy, to no better purpose than to provide necessaries for all, and procure convenience for some."

87

History of the trade with Russia.

The only commerce considered by the Chinese as advantageous to their empire, is that with Russia and Tartary; by which they are supplied with those furs so necessary in the northern provinces. The disputes concerning the limits of the respective empires of Russia and China seem to have paved the way to this commerce. These disputes were settled by treaty on the 27th of August 1689, under the reign of Ivan and Peter Alexiowitz. The chief of the embassy on the part of Russia was Golovin governor of Siberia; and two Jesuits were deputed on the part of the emperor of China; and the conferences were held in Latin, with a German in the Russian ambassador's train, who was acquainted with that language. By this treaty the Russians obtained a regular and permanent trade with China, which they had long desired; but in return they yielded up a large territory, besides the navigation of the river Amour. The first intercourse had taken place in the beginning of the 17th century; at which time a small quantity of Chinese merchandize was procured by some Russian merchants from the Kalmuck Tartars. The rapid and profitable sale of these commodities encouraged certain Siberian Wayvodes to attempt a direct and open communication with China. For this purpose several deputations were sent to the emperor; and though they failed of obtaining the grant of a regular commerce, their attempts were attended with some consequences of importance. Thus the Russian merchants were tempted to send traders occasionally to Peking; by which means a faint connection was preserved with that metropolis. This commerce, however, was at last interrupted by the commencement of hostilities on the river Amour; but after the conclusion of the treaty in 1689, was resumed with uncommon alacrity on the part of the Russians: and the advantages thence arising were found to be so considerable, that a design of enlarging it was formed by Peter the Great. Isbrand Ides, a native of the duchy of Holstein, then in the Russian service, was therefore dispatched to Peking in 1692; by whose means the liberty of trade, before confined to individuals, was now extended to caravans. In the mean time, private merchants continued to trade as before, not only with the Chinese, but also at the head quarters of the Mogul Tartars. The camp of these roving Tartars, which was generally stationed near the confluence of the Orhon and Toula rivers between the southern frontiers of Siberia and the Mogul desert, thus became the seat of an annual fair. Complaints, however, were soon made of the disorderly behaviour of the Russians; on which the Chinese monarch threatened to expel them from his dominions entirely, and to allow them neither to trade with the Chinese nor Moguls. This produced another embassy to Peking in 1719, when matters were again adjusted to the

China. the satisfaction of both parties. The reconciliation, was of no long duration; for the Russians having soon renewed their disorderly behaviour, an order for their expulsion was issued in 1722, and all intercourse between the two nations forbidden. The differences were once more made up in 1727, and a caravan allowed to go to Peking once in three years, provided it consisted of no more than 100 persons; and that during their stay their expences should not, as formerly, be defrayed by the emperor of China. The Russians at the same time obtained permission to build a church within the precincts of the caravansary; and that four priests were allowed to reside at Peking for the celebration of divine service; the same indulgence being granted to some Russian scholars, for the purpose of learning the Chinese language, and qualifying themselves for being interpreters between the two nations. This intercourse continued till the year 1755; since which time no more caravans have been sent to China. It was first interrupted by a misunderstanding betwixt the two courts; and though that difference was afterwards made up, no caravans have been sent ever since. The empress of Russia, sensible that the monopoly of the fur trade (which was entirely confined to the caravans belonging to the crown, and prohibited to individuals) was prejudicial to commerce, gave it up in favour of her subjects in 1762; and the centre of commerce betwixt the two nations is now at Kiatka. Here the trade is entirely carried on by barter. The Russians are prohibited from exporting their own coin; finding it more advantageous to take goods in exchange than to receive bullion at the Chinese standard. The principal exports from Russia are furs of different kinds; the most valuable of which are those of sea-otters, beavers, wolves, foxes, martins, sables, and ermines; the greater part of which are brought from Siberia and the newly discovered islands; but as they cannot supply the demand, there is a necessity for importing foreign furs to Petersburgh, which are afterwards sent to Kiatka. Various kinds of cloth are likewise sent to China, as well as hardware, and live cattle, such as horses, camels, &c. The exports from China are, raw and manufactured silk, cotton, porcelain, rhubarb, musk, &c. The government of Russia likewise reserves to itself the exclusive privilege of purchasing rhubarb. It is brought to Kiatka by some Bukharian merchants, who have entered into a contract to supply the crown with it in exchange for furs: the exportation of the best rhubarb is forbidden under severe penalties, but yet is procured in sufficient quantities, sometimes by clandestinely mixing it with inferior roots, and sometimes by smuggling it directly. Great part of Europe is supplied with rhubarb from Russia.

88 Emperor's revenue.

The revenue of the emperor of China amounts to more than 41 millions sterling; and might easily be increased, did the sovereign incline to burden his subjects with new impositions. The annual expences of government are indeed immense, but they are regulated in such a manner as never to be augmented but in cases of the utmost necessity; it even happens very often that administration makes greater savings every year. When this happens to be the case, the surplus serves to increase the general treasure of the empire, and prevents the necessity of new impositions in time of war, or other public calamities. The greater part of the taxes are paid in kind; those, for instance, who breed silk worms, pay their taxes in silk, the husbandmen in grain, the gardeners in fruits, &c. This method, at the same time that it is exceedingly convenient for the subject, is no way detrimental to the public interest. There are numbers of people every where in the service of government, who are thus furnished with food and clothing; so that the commodities collected as taxes are almost consumed in the provinces where they are levied; what remains is sold for the behoof of the emperor, and the money deposited in the imperial treasury. The taxes paid in money arise principally from the customs and sale of salt (which belongs entirely to the emperor), from the duties paid by vessels entering any port, and from other imposts on various branches of manufactures. Excepting these, the trader scarcely contributes any thing to the exigencies of the state, and the mechanic nothing at all; the whole burden of taxation thus falling upon the husbandman. This burden is regulated in proportion to the extent and fertility of his lands; and the greatest care has been taken to manage matters so, that he may neither be overcharged in the imposition nor harassed in the levying of the duties. "The registering of lands (says M. Grosier), so often and to no purpose projected in France, has been long practised in this empire, notwithstanding its prodigious extent."

89 Of the taxes in China.

The levying of taxes in China is as simple as the nature of the thing will admit of. The duties levied from towns and villages are carried to cities of the third class; then they are conducted to those of the second; then to those of the first; and at last to the capital. The levying and imposition of taxes is submitted to the tribunal of finances; and matters are so managed, that besides the consumption in each district for discharging the ordinary expences of government, something is left by way of reserve for answering accidental demands, and to be ready in cases of necessity. This sum becomes gradually less from the capital to cities of the first, second, and third class. A proper statement of what is paid in the provinces, of what is reserved in the different cities, or contained in the different treasuries of the empire, is subjected to the examination of the grand tribunal of finances. This revises the whole, and keeps an exact account of what is consumed, and of whatever surplus may be left.

90 Of lending money, and deficiencies in paying interest.

Lending money upon interest has been in use in China for about 2000 years. It has often been abolished, and as often established. The interest, as has been already hinted, is no less than 30 *per cent.* and the year is only lunar. A tenth part of this interest is paid monthly; and concerning neglects of payment, the following laws have been enacted. "However much the debt may have accumulated by months or years, the principal and interest shall remain always the same. Whoever infringes this law shall receive 40 blows of a *pan-tsee*; or an hundred, if he uses any artifice to add the principal and interest together." This law is explained by the following. "Whoever shall be convicted before a mandrain of not having paid a month's interest, shall receive ten blows; twenty for two months, and thirty for three; and in this manner as far as sixty; that is to say, to the sixth month. The

debtor

China.

debtor is then obliged to pay principal and interest; but those who obtain payment by using violence and force, are condemned to receive 24 blows.

Many Chinese writers have endeavoured unsuccessfully to show why government should allow such exorbitant interest to be taken for money; but the most satisfactory and rational account seems to be, that the great interest of money prevents the rich from purchasing much land; as landed estates would only embarrass and impoverish them, their produce being so much inferior to that of money. The patrimony of a family in China is seldom divided; and it never happens there, as in almost every other country, that wealth and riches are engrossed by one part of the nation, while the other possesses nothing.

91 Agriculture greatly encouraged.

Agriculture is by the Chinese considered as the first and most honourable of all professions; so that in this empire the husbandman enjoys many and great privileges, while the merchant and mechanic are much less esteemed. Part of the crop is allowed to be used in distillation; but if the harvest happens to be bad, this operation is prohibited. In China, the tillage of the earth is not only encouraged by law, but also by the example of the emperor, who annually tills the earth with his own hands. The beginning of spring in China is always reckoned to be in the mouth of February; but it belongs to the tribunal of mathematics to determine the precise day. The tribunal of ceremonies announces it to the emperor by a memorial; in which every thing requisite to be done by him is mentioned with the most scrupulous exactness. The sovereign then names 12 of the most illustrious persons in his court to accompany him, and to hold the plough after he has performed his part of the ceremony. Among these there are always three princes of the blood, and nine presidents of supreme courts; and if any of them are too old and infirm to undergo the fatigue, the substitutes must be authorised by the emperor. The festival is preceded by a sacrifice, which the emperor offers up to *Chang-ti* (the supreme God); after which he and his attendants prepare themselves by three days fasting and continence. Others are appointed by the emperor, on the evening before the ceremony, to go and prostrate themselves at the sepulchre of his ancestors, and to acquaint them, that, on the day following, he intends to celebrate a grand sacrifice. This is offered up on a small mount a few furlongs distant from the city, which, by the indispensable rules of the ceremony, must be 50 feet in height. The Chang-ti is invoked by the emperor, who sacrifices under the title of sovereign pontiff, and prays for an abundant harvest in favour of his people. He then descends, accompanied by the three princes and nine presidents who are to put their hands to the plough along with him; the field set apart for this purpose being at a small distance from the mount. Forty labourers are selected to yoke the oxen, and to prepare the seeds which the emperor is to sow; and which are of five different kinds, viz. wheat, rice, two kinds of millet, and beans. They are brought to the spot in magnificent boxes, carried by persons of the most distinguished rank. The emperor then lays hold of the plough, and turns up several furrows; the princes of the blood do the same, and then the presidents; after which the emperor throws into the furrows the five kinds of seeds already mentioned: lastly, four pieces of cotton-cloth, proper for making dresses, are distributed to each of the labourers, who assist in yoking the oxen and preparing the seeds; and the same presents are made to 40 other persons who have only been spectators of the ceremony.

92 Ceremony of the emperor tilling the earth with his own hands.

93 Of the peasants.

"We must not (says M. Grosier) judge of the Chinese peasants from those of Europe, especially in what relates to the lights acquired by education. Free schools are very numerous in every province of China, and even some of the villages are not destitute of this advantage. The sons of the poor are there received as readily as those of the rich; their duties and their studies are the same; the attention of the masters is equally divided between them; and from this obscure source talents often spring, which afterwards make a conspicuous figure on the grand stage of life. Nothing is more common in China than to see the son of a peasant governor of that province in which his father had long toiled in cultivating only a few acres. The father himself, if taken from his plough, and elevated to a superior sphere, might, by reviving the instruction he received in his youth, and especially if he be endowed with genius, find himself fully competent for his new employment."

94 Grosier's defence of the Chinese from the charge of murdering and exposing their children.

The Chinese have been greatly reproached with the inhuman practice of murdering their children; but though our author cannot deny that they are guilty of this practice, he excuses them by saying, that "the crime when committed in China is commonly owing to the fanaticism of idolatry; a fanaticism which prevails only among the lowest of the people. It is either in obedience to the oracle of a bonze, to deliver themselves from the power of magic spells, or to discharge a vow, that these infatuated wretches precipitate their children into the river: they imagine that, by doing so, they make an expiatory sacrifice to the spirit of the river. All nations of antiquity almost have disgraced themselves by the like horrid practices; but the Chinese are far from countenancing this barbarity on that account. Besides, these criminal sacrifices are never practised but in certain cantons of China, where the people, blinded by idolatry, are the dupes of prejudice, fanaticism, and superstition.—It often happens also, that the bodies of those children which are seen floating on the water have not been thrown into it till after their death; and this is likewise the case with those which are found in the streets, or lying near the public roads. The poverty of the parents suggests this dismal resource, because their children are then buried at the expence of the public. Exposing of children in public places is a custom tolerated in China; and government employs as much vigilance to have them carried away in the morning, as it bestows care on their education. This is certainly giving people intimation to expose their children in the night-time, and no doubt encourages the practice; but the dictates of humanity are here united to those of sound policy. No law in China authorises mutilation: there are indeed eunuchs in the empire, but their number is much less than what it is generally supposed to be by Europeans. The greater part of the eunuchs belonging to the emperor and empresses have no higher employment than that of sweeping the courts of justice."

95 Gazette of Peking.

Like the capital cities of European kingdoms, Peking, the metropolis of the Chinese empire, is furnished with a gazette, which circulates into the remotest provinces, and which is even considered by administration as an essential part of the political constitution. It is printed daily at Peking, and contains an account of all those objects to which the attention of administration is directed. In this gazette may be seen the names of all those mandarins who are stripped of their employments, and the causes of their disgrace; it mentions also the names of all those delinquents who are punished with death; of the officers appointed to fill the places of the disgraced mandarins; the calamities which have afflicted any of the provinces; the relief given by government; and the expences incurred by administration for the subsistence of the troops, supplying the wants of the people, repairing or erecting public works; and, lastly, the remonstrances made to the sovereign by the superior tribunals, either with regard to his public decisions or private conduct, and sometimes even with regard to both. Nothing, however, is contained in this gazette that has not immediately come from the emperor, or been submitted to his inspection; and immediate death would be the consequence of inserting a falsehood in this ministerial paper.

96 Seals of the emperor, mandarins, &c.

No law or sentence, as has already been said, is of any force, until the emperor's seal has been affixed to it. This is about 8 inches square, and is made of fine jasper, a kind of precious stone much esteemed in China; of which only the emperor is allowed to have a seal. Those given to princes as marks of honour are composed of gold; the seals of the viceroys and great mandarins, of silver; while those of inferior mandarins and magistrates are made only of lead or copper. The size of those seals is greater or smaller according to the rank their possessors hold in the tribunals or as mandarins; and when any of them happens to be worn out, intimation must be sent to the next superior tribunal; on which a new one is sent, and the old one must then be delivered up. The commission of every inspector sent into the provinces must also be confirmed by the emperor's seal. The duty of these officers is to examine into the conduct of governors, magistrates, and private individuals; and instances are recorded of emperors themselves assuming the office of inspectors in some of the provinces. These officers are not only superior to all the magistrates, but even to the viceroys of the provinces themselves. When a superior magistrate behaves ill to an inferior one, the former instantly becomes the prisoner of the inspector, and is suspended from his office until he has cleared himself from every imputation laid to his charge. The viceroy, however, is allowed to enjoy his office until the report of the inspector has been transmitted to the emperor.

97 Power of the viceroys of provinces.

These viceroys are distinguished by the title of *Tsong-tou*, and are always mandarins of the first class, possessing an almost unlimited power within their districts. They march abroad with all the pomp of royal magnificence, never quitting their palaces, on the most trifling occasion, without a guard of 100 men. A viceroy is the receiver-general of all the taxes collected in the province, transmitting them to the capital, after having reserved what he judges necessary for the demands of his district. All law-suits must be brought before his tribunal; and he has the power of passing sentence of death, but it cannot be put in execution without being first carried to the emperor. Every three years he sends to court a report of the conduct of the mandarins subordinate to him; and according to the contents they are either continued or disgraced. Those of whom he makes an unfavourable report are punished in proportion to their delinquency; while, on the other hand, those who have the good fortune to be well reported, are rewarded in a similar proportion.

98 Degradation of mandarins.

The principal mandarins are sometimes broke and dismissed from all their employments, while others are only removed some degrees lower. Those who have been degraded ten steps, run a great risk of never being employed again. These degraded mandarins are kept in perpetual remembrance of their misfortune, by being obliged to mention it in every public order they issue forth in their inferior station; thus, "I, such a mandarin, degraded one, two, three, *&c.* steps, command and order," *&c.* Over these inferior mandarins the inspector of the province has a very unlimited authority, and can, by his own power, deprive them of their employments for a great offence; nor does he consult the court, excepting where the immediate punishment of the criminal is not necessary. Every one of the mandarins, of whatever rank or denomination, is obliged, once in three years, to give in writing an exact account of the faults he has committed in the execution of his office. If he is a mandarin belonging to any of the four first classes, this confession is examined at court; but if it is made by any of the inferior ones, it must be laid before the provincial tribunal of the governor. Government, however, is not satisfied even with this confession; inquiry is made into the truth of it, and the conduct of the mandarin is scrutinized with the utmost severity, the informations being subjected to the tribunal of mandarins; where they are carefully examined, the merits and demerits of those subjected to this political inquisition carefully balanced, and their names afterwards divided into three classes. The first consists of those for whom rewards and preferment are intended; the second, for whom gentle reproof and admonition are thought necessary; and the third, of those who are to be suspended for some time, or removed altogether, from their offices. Of these last some are allowed to continue; but they receive no salary, and are not only deprived of all their emoluments, but even of their honours. If they have been guilty of any action tending to oppress the people, or to occasion a famine or scarcity among the lower ranks, their punishment is not confined to dismission from their offices, but they are also criminally impeached. The family burying-place of every Chinese is accounted sacred; none dares cut down the trees with which it is overshadowed until they become decayed with age; and even then, not until their condition has been attested by a mandarin: but for certain crimes against government or the people, the burying-place of a mandarin is rased to the foundation. No kind of punishment, however, inflicted on a father, is supposed in the least to affect the character of his son; and therefore, when the latter is asked by the emperor concerning his family, he will perhaps coolly

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cooly answer, "My father was disgraced for such a crime, my grandfather was beheaded for such another," without the acknowledgement being in the least detrimental. On the contrary, by great and important services, it is possible for him to wipe out these stains from the memory of his ancestors.

Though the empire of China is governed by Tartar princes, the latter seem to bestow much more care and attention on the Chinese than their own natural subjects. Should any dispute arise between a Chinese and a Tartar, the former must have greatly deviated from the rules of justice, if he is not acquitted even by those tribunals which are composed of half Chinese and half Tartars. The slightest fault committed by a Tartar mandarin is always severely punished; but the punishment of the greatest is often mitigated if the delinquent be a Chinese; and the same severity is exercised towards those of the military department. Those faults, however, are punished with the greatest severity which hurt the interests of the people: for which reason they seldom fall a sacrifice to that class of petty tyrants who in other countries prey upon and devour them. Every superior mandarin is obliged to inform himself of the faults of his inferiors, and expose them; nay, he would be punished for them himself if he did not.

99 Privileges of princes, &c. in China.

Very little regard, as we have already had occasion to observe, is paid to hereditary right in China. Even the princes of the blood enjoy no other privilege by birth but that of wearing a yellow girdle; and the names of their children, with the exact time of their birth, are inscribed in a yellow book appropriated to that purpose. Collateral princes are distinguished by an orange girdle, and their children are marked in a book of a red colour. The surnames of the princes of the reigning family are determined by the emperor alone; the rest not being allowed to assume any name that too much resembles those of the Moguls or Chinese. The rank even of the emperor's sons diminishes one degree every generation; so that, at the seventh, only the eldest branch has a title to wear the yellow girdle, the rest being sunk into the rank of plain citizens. An hereditary sovereignty, however, passes from one eldest son to another; and this title cannot be forfeited, unless the possessor be guilty of some crime. In this case the emperor appoints to the succession either one of his younger brothers or a cousin: but these must be always chosen from the same branch, as the lawful branch cannot be deprived of its right without the condemnation of all who compose it. The only hereditary authority of the other princes exists among those troops called the *Tartar bands*. There they enjoy, without opposition, that rank which they derive from their birth, but in every thing else are on a level with others. They are subjected to a military examination at stated periods, and are always promoted or degraded according to the degree of skill they exhibit. The same trial is undergone by the heir apparent and his sons; the only indulgence shown them being, that schools are appointed for their particular use. The princes are likewise indulged with a tribunal appropriated on purpose for them, and before which alone they can be tried. An insult offered to a prince decorated with the yellow girdle is punished with death; but if he has omitted to put it on, the aggressor escapes with a bastinading. A prince may be put to death by the emperor's consent; but he escapes every slighter corporal punishment by paying a fine. Untitled princes have very few privileges superior to those of common citizens; and are generally very poor, unless possessed of some lucrative office. Thus they are sometimes reduced to the necessity of accepting the highest pay of a common soldier in the Tartar bands. When they, or any of their children, however, enter into the marriage state, the emperor usually makes them a present of 100 ounces of silver. He will also relieve them on other occasions, assist their widows and orphans, *&c.* but in all this never departs from the most exact rules of economy; so that the mandarins in this respect are much better than the relations of the sovereign himself.

100 F. Amiot's account of the ancient religion of China.

With regard to the ancient religion of China, F. Amiot informs us, that, after making every possible research, comparing and reasoning upon his observations, he at last concluded, that "the Chinese are a distinct people, who have still preserved the characteristic marks of their first origin; a people whose primitive doctrine will be found, by those who take the trouble of investigating it thoroughly, to agree in its essential parts with the doctrine of the chosen people, before Moses, by the comand of God himself, had consigned the explanation of it to the sacred records; a people, in a word, whose traditional knowledge, when freed from whatever the ignorance or superstition of later ages has added to it, may be traced back from age to age, and from epocha to epocha, without interruption, for the space of 4000 years, even to the renewal of the human race by the grandson of Noah." The *king*, or canonical books of the Chinese, every where inculcate the belief of a Supreme Being, the author and preserver of all things. Under him they mention the names of *Tien*, or Heaven; *Chang-tien*, or Supreme Heaven; *Chang-ti*, or Supreme Lord; and of *Hoang-chan-ti*, Sovereign and Supreme Lord: "Names (says M. Grosier) corresponding to those which we use when we speak of God, the Lord, the Almighty, the Most High."

According to the Chinese books, the Supreme Being is the principle of every thing that exists, and the father of all living; he is eternal, immoveable, and independent; his power knows no bounds; his sight equally comprehends the past, present, and the future, penetrating even into the inmost recesses of the heart. Heaven and earth are under his government; all events, all revolutions, are the consequences of his will; he is pure, holy, and impartial; wickedness offends his sight; but he beholds with an eye of complacency the virtuous actions of men. Severe, yet just, he punishes vice in a striking manner even on the throne, and often precipitates from thence the guilty, to place upon it the man who walks after his own heart, whom he hath raised from obscurity. Good, merciful, and full of pity, he relents on the repentance of the wicked: public calamities, and the irregularities of the seasons, are only salutary warnings, which his fatherly goodness gives to men to induce them to reform and amend.

The performance of religious worship at the proper and appointed times, has given occasion to the great exact-

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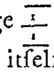
exactness with respect to the kalendar, which is remarkable throughout the empire of China; and all the celebrated emperors have begun their reigns with a reformation of it. Our historians, however, not contented with discovering in the Chinese religion the fundamental principles of the ancient patriarchal religion, have also found in it evident symptoms of a knowledge of the Trinity as believed among Christians. "Among the ancient Chinese characters (says M. Grosier), which have escaped the ravages of time, we find the following △. According to the dictionary of *Kang-hi*, this signifies union; according to the *Choue-ouen* (that book so highly esteemed in China) △ is three united in one; it derives it from the characters *jou* (to enter or penetrate), and *ye*, one; whence it concludes, that △ means three united, penetrated, or incorporated into one. According to another book, accounted a learned and accurate explanation of the ancient characters, '△ signifies strict union, harmony, the chief good of man, of heaven, and of earth; it is the union of the three *tsai* (powers, principles, or intelligencies); for, united, they direct, create, and nourish together. The image  (three united in one figure) is not so obscure in itself; however it is difficult to reason upon it without being deceived: on this subject it is difficult to speak.'

"Father Amiot, spite of all the objections which the critics of Europe may make, seems to conjecture, that the character △ might have been, among the ancient Chinese, the symbol of the most holy Trinity; 'and the more so (he adds), as the ancient books furnish a number of texts, which give us reason to suppose them to have been possessed of some knowledge of this sublime mystery.' The book *See-ki* says, 'The emperor formerly offered up a solemn sacrifice every three years to the Spirit Trinity and Unity, *Chin-san-ye*.' The following celebrated text of *Lao-tse* has long been known in Europe. '*Tao* is one by nature: the first begot the second; two produced the third; the three created all things.'

"F. Amiot quotes another passage, which appears to be no less singular. 'He who is, as it were, visible, and cannot be seen, is named *Khi*; he who may be heard, yet speaketh not to the ears, is called *Hi*; he whom, in a manner, we feel, yet cannot touch, is named *Ouei*. In vain do we interrogate our senses respecting these three: our reason, which alone can give us any satisfaction, will tell us that they make only one. Above there is no light; below there is no darkness. He is eternal; there is no name which can be given him. He resembles nothing that exists; he is an image without figure; a figure without matter: his light is surrounded by darkness. If we look up to him above, we behold no beginning; if we follow him, we discover no end. From what the *Tao* hath been at all times, conclude what he is, viz. that he is eternal: he is the beginning of wisdom.' The commentaries which explain this passage speak in such strong and precise terms, that F. Amiot forbears to quote them, lest he might incur the censure of too many incredulous readers."

101 Sacrifices.

The sacrifices of the Chinese were first offered up in the open fields, or on some mountain, upon what they call the *Tan*, which signifies a quantity of stones thrown together in a round form, or simply a round heap of earth. A double fence, called *Kiao*, composed of turf and branches of trees, was raised around this; and, in the space left between the two fences, two lesser altars were erected on the right and left; upon which, immediately after the sacrifice offered up to the *Tien*, they sacrificed also to the *Cheng*, or good spirits of every rank, and to their virtuous ancestors. The sovereign alone had a right of sacrificing upon this *Tan*; and the custom of sacrificing to inferior spirits, according to the Chinese commentators, may be traced even to the days of *Fo-hi* himself. The same writers add, that, in addressing themselves to the Chang-ti, they considered him as the sovereign lord of the universe, clothed with all that power which was necessary to satisfy them with regard to the different objects of their requests; but that, in offering up their prayers to the inferior objects of worship, they only implored their protection and mediation with the Chang-ti.

While the empire was confined within narrow bounds, one mountain was sufficient for the sacrifices; but in process of time it became necessary to consecrate four others. These were situated at the extremities of the empire, and were supposed to correspond with the four quarters of the world; and the prince went successively every year to one of these mountains to offer up sacrifices; taking occasion at the same time to show himself to his people, and to inform himself of their wants. This custom subsisted for a long time; but at length it was found convenient to add a fifth mountain in the centre of the empire; and ever since these have been called the five *Yo*, or the five mountains of sacrifice. This method of subjecting the emperor to regular annual journies could not but be attended with many inconveniences. It was found necessary on this account to consecrate some spot in the neighbourhood of his palace, which might be substituted for the *Yo* upon all occasions when the emperor could not repair to them. An edifice was therefore erected, which at once represented the *Kiao*, *Tan*, and the *Hall of Ancestors*. This last was a necessary part of the edifice; because it was incumbent on those who offered up sacrifices, first to repair to this hall, and acquaint their ancestors with what they were about to perform; and thither also they returned after sacrificing, to thank the same ancestors for the protection they had received from the Chang-ti; after which they offered up a sacrifice of thanksgiving in honour of them, and performed certain other ceremonies to show their respect. The building contained five separate halls, appropriated to different purposes: originally it had neither paintings nor ornaments of any kind, and a stair-case of nine steps conducted to the principal entrance. Afterwards, however, it was much more richly ornamented, each of the five halls being decorated with columns, over which others were placed that supported the second roof. In succeeding times it was stripped of all its ornaments, with a view to bring back religion to its primitive simplicity. Its four gates were covered with fine moss, representing the branches of which the double fence of the ancient *Kiao* were formed. The ridge of the roof was covered with the same, and the whole was encompassed by a canal filled with water at the time of offering up the sacrifices. To this a second building was added, which they called the

China. the *temple of neatness*, and which was used only for purifications and ceremonies, the former being entirely consecrated to the worship of the Chang-ti.

At present there are only two temples in Peking, named the *Tien-tan* and the *Ti-tan*; in the construction of which all the elegance of Chinese architecture is displayed. These are both dedicated to the Chang-ti, but under different titles; in the one he is adored as the *eternal spirit*; in the other, as the creator and preserver of the world. The ceremonies of the modern sacrifices are greatly multiplied; and nothing can exceed the splendor and magnificence with which these solemnities are performed. Some time before the day appointed for the grand ceremony, the monarch, the grandees of the court, and all those whom their employments qualify to assist at the solemnity, prepare themselves by retirement, fasting, and continence; no audience is given by the emperor, and the tribunals are entirely shut; marriages, funerals, rejoicings, and entertainments of every kind, are then forbidden. At last, on the day appointed, the emperor appears attended by an innumerable multitude, and, his person surrounded by a vast number of princes, lords, and officers, while every part of the temple seems to correspond with the magnificence of the sovereign; all the vases and utensils employed in the sacrifices are of gold, and cannot be employed to any other purpose; even the instruments of music are of enormous magnitude, and never used any where else. All this grandeur, however, serves only to display in a more eminent manner the humility and abasement of the monarch during his devotion; at which time he rolls in the dust, and speaks of himself before the *Chang-ti* in terms of the most abject submission and humiliation.

102 Sect of Tao-sse.

The purity of the ancient Chinese religion has, however, been long contaminated by many idolatrous and fanatical sects. Among these, one named *Tao-sse* was founded by a philosopher called *Lao-kiun* or *Lao-tse*, who was born 603 B. C. He died in an advanced age, leaving to his disciples a book intitled *Tao-te*, being a collection of 5000 sentences. His morality has a great resemblance to that of Epicurus. It consists principally in banishing all vehement desires and passions capable of disturbing the peace and tranquillity of the soul. According to him, the care of every wise man ought to be only to endeavour to live free from grief and pain, and to glide gently down the stream of life devoid of anxiety and care. To arrive at this happy state, he advises his followers to banish all thoughts of the past, and to abstain from every vain and useless inquiry concerning futurity, as well as all tormenting thoughts of ambition, avarice, &c. It was found by the disciples of this philosopher, however, that all these endeavours to obtain a perfect tranquillity of mind were vain, as long as the thoughts of death intervened; they therefore declared it possible to discover a composition from which drink might be made that would render mankind immortal. Hence they were led to the study of chemistry; and, like the western alchemists, wearied themseves in search of the philosopher's stone, until at last they gave themselves up to all the extravagancies of magic.

The desire of avoiding death, together with the credulity natural to unenlightened minds, quickly produced a number of converts to the sect of *Tao-sse*. Magical practices, the invocation of spirits, and the art of foretelling events by divination, quickly diffused themselves over the empire, and the imbecillity of the emperors contributed to propagate the deception. Temples consecrated to spirits quickly reared their heads in every corner of the empire; and two of the most celebrated of the sect were authorised to maintain public worship there after the form which had been prescribed by their master. At the same time they distributed, and sold at a dear rate, images of the imaginary spirits with which they had peopled the heavens and the earth. These were, by their command, worshipped as so many deities independent of the Supreme Being; and, in like manner, several of the ancient emperors were invoked as gods.

Being patronised by the emperors of several dynasties, this sect became more and more powerful. At last they had the impudence to affix, during the night-time, to one of the gates of the imperial city, a book filled with mystic characters and magical figures. At break of day they informed the emperor of the sudden appearance of this book, and publicly declared that it was fallen from heaven. This trick easily imposed upon the weak prince. He immediately repaired, with a numerous train, to the spot where the sacred volume appeared; and having taken it into his hands in a respectful manner, carried it in triumph to his palace, where he shut it up in a golden box. Another emperor carried his reverence for the sect to such an height of impiety and extravagance, as to order a celebrated *Tao-sse* to be publicly worshipped under the name of *Chang-ti*. The sect thus patronised by the princes, and accommodated to the credulity of the vulgar, continued to gain ground in spite of every opposition from the wiser part of the people, and is still very powerful in China. At present they offer up three different victims, a hog, a fowl, and a fish, to a spirit whom they invoke. Various ceremonies, such as howling, drawing fantastical figures upon paper, making an hideous noise with kettles and drums, are used in their incantations; and though it may readily be believed that they are for the most part unsuccessful, yet their credit is still kept up by those cases in which they succeed by accident.

The chief of the *Tao-sse* is invested by government with the dignity of grand mandarin, which is enjoyed by his successors; he resides in a sumptuous palace in a town of Kiang-si; and the superstitious confidence of the people attracts an immense number thither from all parts of the empire. Some arrive in order to be cured of diseases, others to get an insight into futurity. The impostor distributes to them small bits of paper filled with magical characters; and the ignorant wretches depart well satisfied, without grudging the expence of their journey, though ever so long.

103 Of the worshippers of Fo.

A still more pernicious and more widely diffused sect is that of the idol *Fo*, which came orignally from India. The *Tao-sse*, had promised to the brother of one of the emperors of China to introduce him to a communication with spirits. The credulous prince having heard of a great spirit named *Fo*, who resided in India, prevailed on his brother to send an embassy thither. On the arrival of the ambassadors, however, they could find only two worshippers of this diety, both of whom they brought to China. Several images of

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of Fo were alſo collected at the ſame time; and theſe, together with ſome canonical books of the Indians, were placed on a white horſe, and carried in proceſſion to the imperial city.

This ſuperſtition was introduced into China about the 65th year of the Chriſtian æra, and ſoon made vaſt progreſs. One of its principal doctrines is that of the metempſychoſis, or tranſmigration of ſouls, of which M. Groſier thinks he was the inventor, and that Pythagoras, who travelled into ſeveral parts of India, had borrowed the doctrine from him. The account given of him by the bonzes is, that finding himſelf, at the age of 70, oppreſſed with infirmities, he called his diſciples together, and told them he was unwilling to leave the world without communicating the ſecret and hidden myſteries of his doctrine; which were, in ſhort, that all things had proceeded from a vacuum and nothing, and to that they muſt return. This doctrine produced a correſponding mode of action, or rather of inaction, in thoſe who believed it: for thus the great happineſs of man was made to conſiſt in abſolute annihilation; and therefore the nearer he could bring himſelf to this ſtate during life, the happier he was ſuppoſed to be.

The common doctrine, however, which admits of a diſtinction between good and evil, finds more proſelytes among the vulgar, whoſe ſituation in life will not allow them to ſpend their time in perpetual idleneſs. According to this, the righteous will be rewarded and the wicked puniſhed after death. They ſay alſo, that the god Fo came to ſave mankind, and to expiate their ſins; and that he alone can procure them a happy regeneration in the life to come. Five precepts are likewiſe inculcated on thoſe who adopt this doctrine: 1. Not to kill any living creature. 2. Not to take away the goods of another. 3. Not to pollute themſelves by uncleanneſs. 4. Not to lie; and, 5. Not to drink wine. Above all, they recommend to them to perform acts of mercy, to treat their bonzes well, build temples, &c.

The doctrine of metempſychoſis has introduced into China an infinite number of idols, who are all worſhipped on the ſuppoſition that the ſpirit of Fo has tranſmigrated into the animals they repreſent. Theſe idols, however, ſeem not to be worſhipped with great ſincerity; but, like the images of ſaints in the more ſuperſtitious countries of Europe, are beaten and thrown in the dirt when their votaries happen not to obtain their deſires, which they impute to the obſtinacy or weakneſs of the idol. Nay, M. Groſier gives an account of one man, who having ineffectually paid a ſum of money to the bonzes of a certain idol for the cure of his daughter, brought a formal accuſation againſt the idol itſelf; and in ſpite of all that the bonzes could ſay in its behalf, got its worſhip ſuppreſſed throughout the province.

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Bad character of the bonzes.

The bonzes of China are repreſented as a moſt avaricious and hypocritical race of men, ready to practiſe every kind of villany, and even to ſubject themſelves to the moſt intolerable tortures, in order to obtain money from the compaſſion of the public when they cannot get it in any other way; and an edict of one of the emperors is cited by M. Groſier, by which great numbers of their religious houſes were ſuppreſſed. In order to perpetuate their ſect, they purchaſe young children, whom they take care to inſtruct in all the myſteries and tricks of their profeſſion; but excepting this, they are in general very ignorant, and few of them would be able to give any tolerable account of the tenets of their own ſect. They are not ſubject to a regular hierarchy, but acknowledge ſuperiors among them whom they call grand bonzes, who have the firſt place in all religious aſſemblies at which they happen to be preſent; and great profit is derived from certain religious clubs, both of men and women, at which the bonzes are always called to aſſiſt. Their wealth is likewiſe augmented by pilgrimages to certain places where there are temples more or leſs reverenced, and where a multitude of abſurd ceremonies are performed. Theſe bonzes, as may be eaſily imagined, are inveterate enemies to the progreſs of Chriſtianity, telling the moſt abſurd ſtories concerning the miſſionaries: as that they pluck out the eyes of their converts to conſtruct teleſcopes with, &c. The literati, however, and the more ſenſible part of the nation, hold them in the greateſt contempt.

105
Ridiculous ſuperſtition of the *fong-choui*.

We ſhall conclude this detail of the Chineſe religion with giving an account of one other ſuperſtition which ſeems peculiar to the nation. It is named *fong-choui*, which ſignifies wind and water. By this they mean the lucky or unlucky ſituation of a houſe, burying-place, &c. If any imprudent perſon has built a houſe cloſe to that of a Chineſe, in ſuch a manner that the angle formed by its roof flanks the wall or roof of the former houſe, the proprietor ever after lives in terror of utter ruin and deſtruction from the malignant influence of that angle. An implacable hatred inſtantly commences betwixt the two families, and often gives riſe to a law-ſuit, which furniſhes matter of diſcuſſion for ſome of the ſuperior tribunals. If no redreſs can be had at law, however, the Chineſe is then reduced to the neceſſity of erecting, on the top of his houſe, an enormous image of a dragon, or ſome other monſter, with its mouth gaping towards the angle, and, as it were, threatening to ſwallow it up; after which the apprehenſions of the proprietor begin to ſubſide, and tranquillity is reſtored to the family. In this manner the governor of *Kien-tchang* ſecured himſelf from the influence of the church of the Jeſuits, which, being built on an eminence, overlooked his palace. Not depending, however, entirely on the good offices of his tutelary dragon, he alſo took the wiſe precaution of altering his principal apartments, and raiſing, at the diſtance of 200 paces from the church, a kind of large facade three ſtories high. But unluckily the death of his ſucceſſor was attributed to this facade; for the mandarin being attacked with a diſorder in his breaſt, which made him ſpit up a white phlegm, this ſymptom was thought to be owing to the walls of the facade, which were very white, and which were forthwith painted black. The ſalutary precaution, however, happened to be taken too late; for the governor died notwithſtanding the black colour of the walls.

"We ſhould never have done (ſays M. Groſier), were we to relate all the ſuperſtitious ideas of the Chineſe, reſpecting the lucky and unlucky ſituation of houſes, the quarter which doors ought to front, and the plan

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plan and day proper for conſtructing the ſtoves in which they cook their rice." But the object on which they employ their greateſt care is the choice of the ground and ſituation for a burying-place. Some quacks follow no other profeſſion than that of pointing out hills and mountains which have an aſpect favourable for works of that kind. When a Chineſe is perſuaded of the truth of ſuch information, there is no ſum which he would not give to be in poſſeſſion of the fortunate ſpot. The greater part of the Chineſe are of opinion that all the happineſs and misfortunes of life depend upon the *fong-choui*.

106 Jews and Mahometans in China.

A colony of Jews was eſtabliſhed in China about the year 206 B. C.; but they are now reduced to a ſmall number of families at Cai-fong, the capital of the province of Honan. The Mahometans have multiplied much more than the Jews. It is above 600 years ſince they firſt entered the empire, where they have formed different eſtabliſhments. At firſt their number was augmented only by marriages; but for ſome time paſt they have been more particularly attentive to the extending of their ſect and propogating their doctrine. The principal means employed for this purpoſe are, to purchaſe a great number of children brought up in idolatry, whom their poor parents are glad to part with; and theſe they circumciſe, and afterwards inſtruct in the principles of their religion. During the time of a famine which deſolated the province of Chang-tong, they purchaſed more than 10,000 of theſe children; for whom, when grown up, they procured wives, built houſes, and even formed whole villages of them. They are now become ſo numerous, that in the places where they reſide they entirely exclude every inhabitant who does not believe in their prophet, and frequent a moſque.

107 Ceremonies of marriage.

With regard to the manners of the Chineſe, they bear no reſemblance to thoſe of any other nation; and, if we may believe their hiſtorians, they are the ſame at this day that they were 4000 years ago. The women are condemned almoſt to perpetual impriſonment within the precincts of their own houſes, and are never ſeen even by their intended huſbands before marriage. He knows nothing of her looks or perſon but from the account of ſome female relation or confident, who in ſuch caſes acts the part of match-maker; though, if impoſed upon either with regard to her age or figure, he can have recourſe to a divorce. The ſame matrons who negociate the marriage, alſo determine the ſum which the intended huſband muſt pay to the parents of the bride: for in China a father does not give a dowry to his daughter; it is the huſband who gives a dowry to the wife. When the day appointed for the marriage is arrived, the bridge is placed in a chair or cloſe palanquin, the key of which is committed to the care of a truſty domeſtic, who muſt deliver it to none but the huſband. The latter richly dreſſed, waits at his gate for the arrival of the proceſſion. As ſoon as it approaches the key is put into his hands; he eagerly opens the chair, and for the firſt time perceives his good or bad fortune. If he is contented with his new ſpouſe, the bride deſcends and enters the houſe, where the marriage is concluded by feaſting and merriment as in other countries; but if the bridegroom is very much diſappointed, he ſuddenly ſhuts the chair, and ſends the bride home to her relations. To get rid of her in this manner, however coſts a ſum equal to what he originally gave in dowry to obtain her.

The Chineſe women, even of the firſt rank, ſeldom quit their apartment, which is ſituated in the moſt retired part of the houſe, and in which they are ſecluded from all ſociety but that of their domeſtics. The book of ceremonies requires that there ſhould be two apartments in every houſe; the exterior one for the huſband, the interior for the wife. They muſt even be ſeparated by a wall or wooden partition, the door of which is carefully guarded; nor is the huſband at liberty to enter the wife's apartment, or ſhe to quit it, without ſufficient reaſon. According to the ſame book, the prattling and loquacity of a woman are reckoned ſufficient grounds for a divorce. A woman, however, cannot be divorced on any account, if ſhe loſes her parents after marriage, or if ſhe has worn three years mourning for the loſs of her huſband, father, or mother.

A widow of any rank above the common, who has children, ſeldom enters a ſecond time into the marriage ſtate, though thoſe of the ordinary rank generally do. The poorer ſort are not at liberty to follow their own inclination; but are ſold for the behoof of the parents of the deceaſed. As ſoon as the bargain is concluded, a couple of porters bring a chair, which is guarded by a number of truſty people. In this the widow is ſhut up, and thus conducted to her new huſband.

"Maſters (ſays Mr Groſier), for the moſt part are very deſirous of promoting marriage among their ſlaves, whatever Mr *Paw* may ſay; who, without any foundation, has ventured boldly to aſſert the contrary. They have even very ſtrong motives to induce them to encourage theſe marriages; the children produced by them are ſtill their ſlaves; and beſides their becoming new property to them, the fathers and mothers are thus more ſtrongly attached to their ſervice." 108

Concubinage tolerated.

Concubinage is tolerated in China, though not authoriſed by any law. This privilege is granted only to the emperor, the princes of the blood, and mandarins; and none but the emperor is permitted to have more than one. The common people generally avail themſelves of the toleration granted them in this reſpect, and will have two or three concubines if they can afford it. They are, however, careful to excuſe themſelves as well as they can to their wives in this reſpect, pretending only a deſire of having many children, and a number of women to attend their wives. Others, deſirous of having a male child, which perhaps their lawful wife cannot have, take a concubine for this reaſon only, and diſmiſs her as ſoon as their wiſhes are accompliſhed: they then permit her to marry whom ſhe pleaſes, and frequently even provide a huſband for her themſelves. Theſe concubines are almoſt all procured from two cities named *Yaug-tcheou* and *Sou-tcheou*, where they are educated, and taught ſinging, dancing, muſic, and every accompliſhment ſuitable to women of quality, or which can render them agreeable and pleaſing. The greater part of them are purchaſed in other places, to be again diſpoſed of; and this is the principal branch of trade carried on by theſe two cities. Unlawful intrigues are ſeldom heard of in China. Whoever ſeduces the wife of another is

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is punished with death: and the same punishment is generally inflicted on the person who debauches a young woman.

109 Education of children.

From the accounts we have of the education of children in China, one might be apt to conclude, that, instead of being the ignorant superstitious race already described, they ought to be the most intelligent people in the world. The book of ceremonies directs the education of a child to commence as soon as it is born, and describes exactly the qualities which its nurse ought to have. She must speak little, adhere strictly to truth, have a mild temper, behave with affability to her equals, and with respect to her superiors. The child is taught to use the right hand as soon as it can put its hand to its mouth, and then it is weaned. At six years of age, if a male, he is taught the numbers most in use, and made acquainted with the names of the principal parts of the world; at seven, he is separated from his sisters, and no longer allowed to eat with them, nor to sit down in their presence; at eight, he is instructed in the rules of good breeding and politeness; at nine, he studies the kalendar; at ten he is sent to a public school, where he learns to read, write, and cast accounts; from 13 to 15 he is taught music, and every thing that he sings consists of moral precepts. It was formerly the custom, that all the lessons designed for the Chinese youth were in verse: and it is to this day lamented, that the same custom is not followed, as their education has since been rendered much more difficult and laborious.

At the age of 15, the Chinese boys are taught to handle the bow and arrow, and to mount on horseback; at 20 they receive the first cap, if they are thought to deserve it, and they are permitted to wear silk dresses ornamented with furs; but before that period they are not allowed to wear any other thing than cotton.

Another method of initiating children into the principles of knowledge in this empire is, by selecting a number of characters expressive of the most common objects, engraving or painting them separately on some kind of substance, and, under the thing represented, putting the name, which points out to the children the meaning of the word.

As the Chinese have no proper alphabet, they represent almost every thing by different characters. The labour of their youth, therefore, is intolerable; being obliged to study many thousand characters, each of which has a distinct and proper signification. Some idea of their difficulties may be obtained from what we are told by F. Martini, who assures us, that he was under the necessity of learning 60,000 different characters before he could read the Chinese authors with tolerable ease.

The book first put into the hands of the Chinese children is an abridgment, which points out what a child ought to learn, and the manner in which he should be taught. This volume is a collection of short sentences, consisting of three or four verses each, all of which rhyme; and they are obliged to give an account in the evening of what they have learned in the day. After this elementary treatise, they put into their hands the four books which contain the doctrines of Confucius and Mencius. The sense and meaning of the work is never explained to them until they have got by heart all the characters, that is to say, the *words* in the book: a method no doubt inconceivably disgusting, and calculated utterly to destroy the genius of a boy, if he has any. While they are getting these characters by heart, indeed, they are likewise employed in learning to form them with a pencil. For this purpose they are furnished with large leaves of paper, on which are written or printed with red ink very big characters; and all they are required to do is to cover those red characters with black ink, and to follow exactly their shape and figure: which insensibly accustoms them to form the different strokes. After this they are made to trace other characters, placed under the paper on which they write. These are black, and much smaller than the other. It is a great advantage to the Chinese literati to be able to paint characters well; and on this account they bestow great pains in forming the hands of young people. This is of the utmost consequence to literary students in the examinations which they are obliged to undergo before they can be admitted to the first degree. Du Halde gives a remarkable instance, *viz.* that "a candidate for degrees having, contrary to order, made use of an abbrevation in writing the character *ma*, which signifies an horse, had the mortification of seeing his composition, though in other respects excellent, rejected merely on that account; besides being severely rallied by the mandarin, who told him that a horse could not walk unless he had all his legs."

After the scholar has made himself master of the characters, he is then allowed to compose; but the subject of his composition is pointed out to him only by one word. Competitions are likewise established in China, but most of them are of a private nature. Twenty or thirty families, who are all of the same name, and who consequently have only one hall for the names of their ancestors, agree among themselves to send their children twice a month to this hall in order to compose. Each head of a family in turn gives the subject of this literary contest, and adjudges the prize; but this costs him a dinner, which he must cause to be carried to the hall of competition. A fine of about ten pence is imposed on the parent of each scholar who absents himself from this exercise.

Besides these private competitions, every student is obliged to compete at least twice a-year under the inspection of an inferior mandarin of letters, styled *Hio-kouan*. It frequently happens also, that the mandarins of letters order these students to be brought before them, to examine the progress they have made in their studies, to excite a spirit of emulation among them, and make them give such application as may qualify them for any employment in the state. Even the governors of cities do not think it below their dignity to take this care upon themselves; ordering all those students who reside near them to appear before their tribunal once a month: the author of the best composition is honoured with a prize, and the governor treats all the candidates on the day of competion at his own expence. In every city, town, and village in China, there are schoolmasters who teach such sciences as are known in that country. Parents possessed of a certain fortune provide masters for their children, to attend and instruct them, to form their minds to virtue, and to initiate them in the rules of good breeding and the accustomed ceremonies, as well as to make them acquainted

China. quainted with the laws and history, if their age will admit. These masters have for the most part attained to one or two degrees among the literati, and not unfrequently arrive at the first employments of the state.

The education of the Chinese women is confined to giving them a taste for solitude, and accustoming them to modesty and silence; and, if their parents are rich, they are likewise instructed in such accomplishments as may render them agreeable to the other sex.

110 Dress. There is little distinction in China between the ordinary dress of men and women. Rank and dignity are distinguished by certain accessary ornaments: and the person would be severely chastised who should presume to assume them without being properly authorised. The dress in general consists of a long vest which reaches to the ground. One part of this vest, *viz.* that on the left side, folds over the other, and is fastened to the right by four or five small gold or silver buttons, placed at a little distance from one another The sleeves are wide towards the shoulder, growing narrower as they approach the wrist, where they terminate in the form of a horse shoe, covering the hands entirely, and leaving nothing but the ends of the fingers to be seen. Round their middle they wear a large gridle of silk, the ends of which hang down to their knees. From this griddle is suspended a sheath, containing a knife and two of those small sticks which they use as forks. Below this robe they wear a pair of drawers, in summer made of linen, and in winter of satin lined with fur, sometimes of cotton, and in some of the northern provinces of skins. These are sometimes covered with another pair of white taffety. Their shirts are always very short and wide, of different kinds of cloth, according to the season. Under these they wear a silk net to prevent it from adhering to the skin. In warm weather they have their necks always bare; when it is cold, they wear a collar made of silk, sable, or fox's skin, joined to their robe, which in winter is trimmed with sheep's skin, or quilted with silk and cotton. That of people of quality is entirely lined with beautiful sable skins brought from Tartary, or with the finest fox's skin, trimmed with sable; and in the spring it is lined with ermine. Above their robe they wear also a kind of sur-tout with wide sleeves, but very short, which is lined in the same manner. The emperor and princes of the blood only have a right to wear yellow; certain mandarins have liberty to wear satin of a red ground, but only upon days of ceremony; in general they are clothed in black, blue, or violet. The common people are allowed to wear no other colours but blue or black; and their dress is always composed of plain cotton cloth.

111 Chinese obliged by the Tartars to cut off their hair. Formerly the Chinese were at great pains to preserve their hair; but the Tartars, who subdued them, compelled them to cut off the greater part of it, and to alter the form of their clothes after the Tartar fashion. This revolution in dress was not effected without bloodshed, though the conqueror at the same time adopted in other respects the laws, manners, and customs of the conquered people. Thus the Chinese are painted as if bald, but they are not so naturally; that small portion of hair which they preserve behind, or on the tops of their heads, is all that is now allowed them. This they wear very long, and plait like a tail. In summer they wear a kind of cap shaped like an inverted cone, lined with satin, and covered with ratan or cane very prettily wrought. The top terminates in a point, to which they fix a tuft of red hair, which spreads over it, and covers it to the brims. This hair grows between the legs of a kind of cow, and is capable of taking any colour, especially a deep red. This ornament is much used, and any person who chooses may wear it.

The mandarins and literati wear a cap of the same form as the foregoing, only it is lined with red satin, and covered on the outside with white. A large tuft of the finest red silk is fixed over it, which is suffered to hang down or wave with the wind. People of distinction generally use the common cap when they mount on horseback or during bad weather; being better calculated to keep off rain, and shelter those who wear it from the rays of the sun. For winter they have another cap bordered with sable, ermine, or fox's skin, and ornamented with a tuft of silk like the former. In these fur-trimmings they are very curious, sometimes expending 40 or 50 ounces of silver upon them.

The Chinese people of rank never go abroad without boots made of satin, or some other silk, and sometimes of cotton, but always dyed. They have neither heel nor top, and are made to fit the foot with the greatest exactness. When they travel on horseback, however, they have others made of the skin of a cow or horse made very pliable. Their boot-stockings are of silk stuff, quilted and lined with cotton, reaching above the top of their boot, and ornamented with a border of velvet or cloth. In summer they wear a cooler kind, and in their houses a sort of slippers made of silk stuff. The common people are contented with black slippers made of cotton cloth. The fan is also a necessary appendage of the Chinese dress, and is reckoned equally necessary with the boots.

The dress of the women consists of a long robe quite close at top, and long enough to cover even their toes, with sleeves so long that they would hang down upon the ground, did they not take care to tuck them up; but their hands are seldom seen. The colour of their dresses is entirely arbitary, but black and violet are generally chosen by those advenced in life. The young ladies, like those of Europe, make use of paint to give a bloom to their complections; but this, though not the same with the kind used in Europe, agrees with it in the effect of soon wrinkling the skin. Their general head-dress consists in arranging their hair in several curls, among which are interspersed small tufts of gold or silver flowers. According to Du Halde, some of them ornament their heads with the image of a fabulous bird, concerning which many stories are told. This is made of copper or silver gilt, its wings extended and lying pretty close to the head-dress, embracing the upper part of their temples, while the long spreading tail forms a kind of plume on the top of the head. Its body is directly over the head, and the neck and bill hang down, the former being joined to the body by a concealed hinge, in order that it may play freely, and move about on the least motion of the head. The whole bird adheres to the head by means of the claws, which are fixed in the hair.

Ladies of quality sometimes wear several of these birds made up into a single ornament, the workmanship of which is very expensive. Young ladies wear also a crown made of paſteboard, the fore-part of which riſes in a point above the forehead, and is covered with jewels. The reſt of the head is decorated with natural or artificial flowers, among which ſmall diamond pins are interſperſed. The head-dreſs of the ordinary claſs of women, eſpecially when they are advanced in years, conſiſts only of a piece of very fine ſilk wrapped round their heads.

112
Abſurd cuſtom of preventing the feet of female infants from growing.

All authors agree, that an abſurd cuſtom prevails throughout China of confining the feet of female infants in ſuch a manner that they are never allowed to grow to near their full ſize. The ſmallneſs of their feet is accounted ſuch a valuable beauty, that the Chineſe women never think they can pay too dear for it. As ſoon therefore as a female infant is born, the nurſe wraps up its feet in very tight bandages; and this torture muſt be endured until their feet have ceaſed to grow. So prevalent is the force of cuſtom, however, that as the child grows up ſhe voluntarily ſubmits to new tortures in order to accompliſh the purpoſe more effectually. Thus the Chineſe women are deprived almoſt entirely of the uſe of their feet; and are ſcarce able to walk, in the moſt aukward hobbling manner, for the ſhorteſt ſpace. The ſhoe of a full grown Chineſe woman will frequently not exceed ſix inches.

The Chineſe uſe white as the colour proper for mourning; and though a ſon cannot wear this while his father and mother are alive, he can uſe no other for three years after their death; and ever afterwards his clothes muſt be of one colour. The law has forbidden the uſe of ſilks and furs to children; and has even preſcribed the time when they are firſt to wear a cap. This is put upon their heads by the maſter of ceremonies himſelf, who addreſſes them in the following manner: "Conſider that you now receive the dreſs of thoſe who have attained to maturity, and that you ceaſe to be children; renounce therefore all childiſh thoughts and inclinations, aſſume a grave and ſerious deportment, apply with reſolution to the ſtudy of virtue and wiſdom, and endeavour to merit a long and happy life." "This ceremony (ſays M. Groſier), which may appear trifling, is attended with the happieſt effects. The Chineſe give a kind of importance to every thing which can inſpire youth with a taſte for morality and a love of good order. It might be uſeful to mankind at every fixed epocha of their lives, to remind them of thoſe new duties impoſed by each ſucceſſive change; but, by uniting the ſolemnity of a public ceremony to this inſtruction, it will make a deeper impreſſion, and remain much longer imprinted on their memories."

115
Exceſſive ceremoniouſneſs of the Chineſe.

Nothing can appear more irkſome to an European than the multitude of ceremonies uſed on all occaſions by the Chineſe. An invitation to an entertainment is not ſuppoſed to be given with ſincerity until it has been renewed three or four times in writing. A card is ſent on the evening before the entertainment, another on the morning of the appointed day, and a third when every thing is prepared and the gueſts ready to ſit down to the table. The maſter of the houſe always introduces his gueſts into the hall, where he ſalutes them one after another. He then orders wine to be brought him in a ſmall cup made of ſilver, porcelain, or precious wood, and placed upon a ſmall varniſhed ſalver. He lays hold of it with both his hands, makes a bow to all the ſurrounding gueſts, and advances towards the fore-part of the hall, which generally looks into a large court. He there raiſes his eyes and the cup towards heaven; after which he pours the wine on the ground. He afterwards pours ſome wine into a ſilver or porcelain cup, makes a bow to the moſt conſiderable perſon in company, and then goes to place the cup on the table before him; for in China every gueſt has a table for himſelf. The perſon for whom he intends this honour, however, generally ſaves him the trouble of placing the cup; calls for wine in his turn, and offers to place the cup on the maſter's table, who endeavours to prevent him; with a thouſand apologies and compliments according to the rules of Chineſe politeneſs. A ſuperior domeſtic conducts the principal gueſt to an elbow chair covered with rich flowered ſilk, where the ſtranger again begins his compliments, and begs to be excuſed from ſitting in ſuch an honourable ſeat, which nevertheleſs he accepts of; and all the reſt of the gueſts do the ſame, otherwiſe the ceremonial would be gone through with each of them. The entertainment is concluded by ſome theatrical repreſentations, accompanied with the muſic of the country; which, however, would give but little pleaſure to an European. Beſides the gueſts, a certain number of people are admitted into the court in order to behold theſe theatrical repreſentations; and even the women are allowed to view them through a wicket, contrived ſo that they may behold them without being ſeen themſelves.

The entertainments of the Chineſe are begun, not by eating, but by drinking; and the liquor they drink muſt always be pure wine. The intendant, or *maitre de hotel*, falling down on one knee, firſt invites the gueſts to take a glaſs; on which each of them lays hold, with both hands, of that which is placed before him, raiſing it as high as his forehead, then bringing it lower down than the table, and at laſt putting it to his mouth; they all drink together, and very ſlowly, taking three or four draughts. While they are drinking, the diſhes on each of the tables are removed, and others brought in. Each of the gueſts has twenty-four ſet before him in ſucceſſion: all of them fat, and in the form of ragouts. They never uſe knives in their repaſts; and two ſmall-pointed ſticks, ornamented with ivory or ſilver, ſerve them inſtead of forks. They never begin to eat, however, until they are invited by the *maitre de hotel;* and the ſame ceremony muſt be gone through every time they are going to take a cup of wine or begin to a new diſh. Towards the middle of the entertainment the ſoup is brought in, accompanied with ſmall loaves or meat-pies. Theſe they take up with their ſmall ſticks, ſteep them in the ſoup, and eat them without waiting for any ſignal or being obliged to keep time with the reſt of the gueſts. The entertainment, however, continues in other reſpects with the utmoſt formality until tea is brought in; after which they retire from table and amuſe themſelves in another hall, or in the garden for a ſhort time, until the deſert be brought in. This, like the entertainment itſelf, conſts of 24 diſhes, which are made up of ſweatmeats, fruits differently prepared, hams and ſalted ducks which have been backed or dried in the ſun, with ſhell and other kinds of fiſh. The ſame ceremonies which preceded the repaſt are now renewed, China. renewed, and every one sits down at the same place he occupied before. Larger cups are then brought in, and the master invites the guests to drink more freely.

These entertainments begin towards evening, and never end till midnight. A small sum of money is given to the domestics; when every one of the guests goes home in a chair preceded by several servants, who carry large lanthorns of oiled paper, on which are inscribed the quality, and sometimes the name, of the master. Without such an attendance they would be taken up by the guard; and the day following they never fail to return a card of thanks to the officer.

Their method of drinking tea is not like that of other nations. A small quantity of bohea, sufficient to tinge the water and render it palatable (for they drink no green), is taken in the morning, and thrown into a vessel adapted to the number in family. This stands till milk warm; in which state it is kept the whole day, and a cup drank now and then without sugar or milk, in order to exhilerate the spirits when exhausted by fatigue: and if a stranger call by accident, or a visitor by appointment, the first thing presented, after the usual ceremonies of meeting, is a very small pipe filled with tobacco of their own growth and a cup of the tea already mentioned, or of some fresh made of better quality, together with sweetmeats, &c. Tea is the daily beverage in China, and is drank by all ranks of people.

Some change has been made in the ceremonial of the Chinese by the Tartar conquest, and some new dishes also introduced by the same means; and here M. Grosier observes, that the Tartars are much better cooks than the Chinese. All their dishes are highly seasoned; and by a variation in the proportions of their spiceries, they are able to form a variety of dishes out of the same materials. None of their viands, however, are more esteemed than stags sinews, and the nests of a particular species of birds, which have the property of giving a most agreeable relish to whatever is mixed with them. Other dishes are introduced at these repasts, which would be accounted very disagreeable with us; such as the flesh of wild horses, the paws of a bear, and the feet of several wild animals. The greater part of these provisions are brought preserved in salt from Siam, Camboya, and Tartary.

114 Chinese wines.

The wines of China have no resemblance to ours either in taste or quality, being procured from rice and not from the vine. A particular kind of rice is employed for making them, and the grain is steeped for 20 or 30 days in water, into which ingredients of a different nature are successively thrown: they afterwards boil it; and as soon as it becomes dissolved by the heat, it immediately ferments, and throws up a vaporous scum not unlike new wine. A very pure liquor is found under this scum, which is drawn off and put into vessels well glazed; From the remaining lyes an inflammable spirit is made, little inferior, and sometimes even superior to the European. Another kind of wine is used by the Chinese, or rather Tartars, called *lamb-wine*. It is very strong, and has a disagreeable smell; and the same may be believed of a kind of spirit distilled from the flesh of sheep; though this last is sometimes used by the emperors.

These entertainments exceed the bounds of ordinary repasts; the Chinese being naturally sober, and those in easy circumstances living chiefly on pork, for which reason a great number of hogs are bred in the country. Their flesh is much easier of digestion, and more agreeable to the taste, than those of Europe. The Chinese hams are in high estimation. The common people live very poorly; being satisfied, in time of scarcity, with the flesh of dogs, horses, cats, and rats, which last are sold publicly in the streets. China.

115 Public festivals.

There are several public festivals annually celebrated in China. One is that already mentioned, in which the emperor tills the ground with his own hands. This is also celebrated on the same day throughout the empire. In the morning the governor of every city comes forth from his palace crowned with flowers, and enters his chair amidst the noise of different instruments which precede it; a great number of people attending, as is usual on all such occasions. The chair is surrounded by litters covered with silk carpets, on which are represented either some illustrious persons who have supported and encouraged agriculture, or some historical painting on the same subject. The streets are hung with carpets, triumphal arches are erected at certain distances, lanthorns every where displayed, and all the houses illuminated. During the ceremony a figure resembling a cow, made of baked earth, with gilt horns, is carried in procession, and of such enormous magnitude that 40 men are scarce sufficient to support it. A child follows with one foot naked and the other shod, who is called the *spirit of labour and diligence*, and keeps continually beating the image with a rod to make it advance. Labourers, with their implements of husbandry, march behind; and the procession is closed by a number of comedians and people in masks. The governor advances towards the eastern gate, and returns in the same manner. The cow is then stripped of its ornaments, a prodigious number of earthen calves taken from its belly and distributed among the people; after which the large figure is broken in pieces and distributed in the same manner. The ceremony is ended by an oration in praise of agriculture, in which the governor endeavours to excite his hearers to the practice of that useful art.

Other two festivals are celebrated in China with still more magnificence than that above described. One of them is at the commencement of the year; the other is called the *feast of lanthorns*. During the celebration the former, all business, whether private or public, is suspended, the tribunals are shut, the posts stopped, presents are given and received, and visits paid. All the family assemble in the evening, and partake of a feast to which no stranger is admitted; though they become a little more sociable on the following day.

The feast of lanthorns ought to take place on the 15th day of the first month, but usually commences on the evening of the 13th, and does not end till that of the 16th. At that time every city and village, the shores of the sea, and the banks of all the rivers, are hung with lanthorns of various shapes and sizes; some of them being seen in the courts and windows of the poorest houses. No expence is spared on this occasion; and some of the rich people will lay out eight or nine pounds sterling on one lanthron. Some of these are very large composed of six wooden frames either neatly painted or gilt, and filled up with pieces of fine transparent silk, upon which are painted flowers, animals, and human figures; others are blue, and made of a transparent kind of horn. Several lamps, and a

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great number of wax candles, are placed in the inside: to the corners of each are fixed streamers of silk and satin of different colours, with a curious piece of carved work on the top. They are likewise acquainted with our magic lanthorn, which they sometimes introduce in this festival. Besides this they have the art of forming a snake 60 or 80 feet in length, filled with lights from one end to the other; which they cause twist itself into different forms, and move about as if it was a real serpent. During the same festival all the varieties of the Chinese fire-works, so justly admired, and which, some time ago at least, surpassed every thing of the kind that could be done in Europe, are exhibited.

116 Magnificence of the viceroys.

Every public ceremony in China is carefully rendered as striking as possible. A viceroy never quits his palace but with a royal train, dressed in his robes of ceremony, and carried in a chair elegantly gilt, which is born upon the shoulders of eight domestics; two drummers marching before the guards, and beating upon copper basons to give notice of his approach. Eight other attendants carry standards of wood varnished, upon which are inscribed in large characters all his titles of honour. After these come 14 flags with the symbols of his office; such as the dragon, tyger, phoenix, flying tortoise, &c. Six officers follow, each bearing a piece of board in shape like a large shovel, on which are written in large golden characters the qualities of the mandarin himself: two others carry, the one a large umbrella of yellow silk, and the other the cover in which the umbrella is kept. The first guards are preceded by two archers on horseback; the latter are followed by others armed with a kind of weapons composed of hooked blades, fixed perpendicularly to long poles ornamented with four tufts of silk, placed at a small distance above one another. Behind these are two other files of soldiers, some of whom carry large maces with long handles; others iron maces in the shape of a snake; others are armed with huge hammers; while those behind them carry long battle-axes in the form of a crescent: others follow, who have battle-axes of another kind; and behind these are some with the hooked weapons already described.

Behind these come soldiers armed with triple-pointed spears, arrows, or battle-axes; having in front two men who carry a kind of box containing the viceroy's seal. Then come two other drummers to give notice of his approach. Two officers follow, having on their heads felt-hats, adorned with plumes of feathers, and each armed with a cane to recommend regularity and good order to the surrounding multitude. Two others bear maces in the form of gilt dragons. These again are followed by a number of magistrates and officers of justice; some of whom carry whips or flat sticks, while others have chains, hangers, and silk scarfs. Two standard-bearers and a captain command this company, which immmediately precedes the governor. His chair is surrounded by pages and footmen, and an officer attends him who carries a large fan in form of a screen: he is followed by several guards differently armed, together with ensigns and other officers, who are also followed by a great number of domestics all on horseback, carrying various necessaries for the use of the mandarin. If he marches in the night-time, instead of flambeaux, as are customary in Europe, large lanthorns, exceedingly pretty, are carried before him; on the transparent part of which are written, in very conspicuous characters, his quality, titles, and rank, as mandarin. These are also intended to give notice to the passengers to stop, and to those who are sitting to rise up with respect; for whoever neglects either the one or the other is sure to receive a severe bastinading.

The emperor marches with still more magnificence, in proportion to his superior quality. The trumpets used in his procession are about three feet long, eight inches in diameter at the lower extremity, and pretty much resembling a bell in shape: their sound is peculiarly adapted to that of the drums. His cavalcade is closed by 2000 mandarins of letters and as many of arms. Sometimes the great mandarins, as well as the emperor, travel in barks. Their attendance is then somewhat different, but the magnificence almost the same. The honours paid to a viceroy who has governed a province with equity are exceedingly great on his departure from it. He has scarcely left the capital of the province when he finds on the highway, for the space of two or three leaugues, tables ranged at certain distances, each of which is surrounded with a long piece of silk that hangs down to the earth. On these wax candles are placed even in the open day; perfumes are burnt upon them; and they are loaded with a profusion of victuals and various kinds of fruit, while tea and wine are prepared for him on others. The people throw themselves on their knees as he passes, and bow their heads even to the earth; some shed tears, or pretend to do so; some present him wine and sweetmeats; others frequently pull off his boots and give him new ones. These boots, which he has perhaps used only for a moment, are considered as a valuable monument: those first taken off are preserved in a cage over the gate of the city; the rest are carefully kept by his friends.

117 Knavish disposition of the Chinese.

Hitherto our author, M. Grosier, has seemed inclined to give a favourable idea of the Chinese, and to cause us look upon them as many degrees superior to ourselves in the practice of virtue and morality; but when he comes to give an account of their dealings in trade, he is then obliged to confess that they are as dishonest and knavish a race as any that exist. "The most frequented fairs of Europe (says he) afford but a faint idea of that immense numbers of buyers and sellers with which the large cities of China are continually crowded. We may almost say, that the one half are employed in over-reaching the other. It is, above all, against strangers that the Chinese merchants exercise, without any sense of shame, their insatiable rapacity. Of this F. du Halde gives a striking example, which might be supported by many others: 'The captain of an English vessel bargained with a Chinese merchant at Canton for several bales of silk, which the latter was to provide against a certain time. When they were ready, the captain went with his interpreter to the house of the Chinese merchant to examine whether they were found in good condition. On opening the first bale, he found it according to his wish, but all the rest were damaged and good for nothing. The captain on this fell into a great passion, and reproached the merchant in the severest terms for his dishonesty. The Chinese, after having heard him for some time with great coolness, replied, 'Blame, Sir, your knave of an interpreter: he assured me that you would not inspect the bales.'

"The lower class of people are, above all, very dexterous

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terous in counterfeiting and adulterating every thing they sell. Sometimes you think you have bought a capon, and you receive nothing but skin; all the rest has been scooped out, and the place so ingeniously filled, that the deception cannot be discovered till the moment you begin to eat it. The counterfeit hams of China have been often mentioned. They are made of a peice of wood cut in the form of a ham, and coated over with a certain kind of earth which is covered with hog's skin. The whole is so curiously painted and prepared, that a knife is necessary to detect the fraud. Mr Osbeck relates, that having one day observed a blind man carrying about for sale some of those trees called by the Chinese *Fo-kei*, he purchased one, which to appearance had fine double red and white flowers; but in a closer examination, he found that the flowers were taken from another tree, and that one calyx was so neatly fitted into the other, with nails made of bamboo, that he should scarcely have discovered the deceit, had not the flowers begun to wither. The tree itself had buds, but not one open flower.

"The robbers in China signalize themselves also by their dexterity and ingenuity, which they display in their profession. They seldom have recourse to acts of violence, but introduce themselves into a house either privately or by forming some connection with the family. It is as difficult in China to avoid robbery as it is to apprehend the criminal in the fact. If we are desirous of finding among the Chinese openness of temper, benevolence, friendship, and, lastly virtue, we must not seek for it in cities, but in the bosom of the country, among that class of men who have devoted themselves to labour and agriculture. A Chinese rustic often discovers moral qualities which would add a lustre to the character of men of the most exalted rank. It appears that rural life naturally inspires sentiments of benevolence; by continually receiving the gifts of nature, the mind is enlarged, and men are insensibly accustomed to diffuse them to those around them."

The internal commerce of China is much greater than that of all Europe; but its foreign trade is by no means equal to that of any of the grand European powers. Its internal commerce is greatly facilitated by the vast number of canals and rivers with which the country is intersected. The Chinese, however, are not at all fitted for maritime commerce: Few of their vessels go beyond the straits of Sunda: their longest voyages to Malacca extend only as far as Acheen, towards the straits of Batavia, and northward to Japan.

Their commerce with the last mentioned island, considering the articles of exchange which they procure at Camboya or Siam, produces them *cent. per cent.* Their trade with the Manillas brings only about 50 *per cent.* Their profit is more considerable about Batavia; and the Dutch spare no pains to invite them to traffic at their settlement. The Chinese traders go also, tho' not very frequently, to Acheen, Malacca, Thor, Patan and Ligor, belonging to Siam and Cochin-china; from whence they bring gold and tin, together with some objects of luxury for the table. A great obstacle to the foreign commerce of the Chinese is their indifference about marine affairs, and the bad construction of their vessels. This they themselves ackowledge: but say, that any attempt to remove it would be derogating from the laws, and subverting the constitution of the empire.

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118 Burying-places described.

The burying-places in China are always situated at a small distance from a city or town, and generally upon some eminence, having pines or cypresses usually planted around them. The form of the tombs is various, according to the different provinces, and the situation of those for whom they are intended. The coffins of the poor are placed under a shade covered with thatch, or inclosed in a small building of brick in the form of a tomb. The tombs of the rich are shaped like a horse-shoe, well whitened, and finished with great taste; but those of the mandarins and people of quality are mu h more sumptuous and elegant. A vault is first constructed, in which the coffin is shut up; over this vault is raised a pyramid of earth well beat together, about 12 feet in height and 10 in diameter. A layer of lime and sand laid over this earth makes a kind of plaster, which renders the whole very durable and solid; various kinds of trees being planted around it in regular order. Before it is placed a large and long table of white marble, on the middle of which are set a censer accompanied with two vases, and the same number of candlesticks of exquisite workmanship. Besides this, a great number of figures, representing officers, eunuchs, soldiers, saddled horses, camels, lions, tortoises, &c. are ranged round the tombs in different rows; which, F. du Halde assures us, produce a very striking effect.

When a Chinese dies in a province in which he was not born, his children have a right, nay it is their indispensable duty, to transport the body to the burying place of their ancestors. A son who should be wanting in this respect, would be disgraced, and his name never placed in the hall of his ancestors. This is a vast building, considered as common to all the branches of the same family; and to which they all repair at a certain season of the year. Sometimes they amount to seven or eight thousand persons, whose fortune, dignity, and rank in society, are all very different; but there no distinction of rank is known; age only gives precedence, and the oldest always takes place of all the rest, though he should be the poorest in the company. The distinguishing ornament of this hall is a long table set against the wall, upon which is generally seen the image of one of their ancestors, who has filled some office of distinction in the empire with honour to himself, or who has been rendered illustrious by his talents and abilities. Sometimes it only contains the names of men, women, and children belonging to the family inscribed upon tablets, together with their age, the day of their death, and the dignities they enjoyed at that time. These tablets are ranged in two rows upon steps, and are only about a foot high each. In the spring, and and sometimes in the autumn, the relations of the deceased repair to this hall, where the only privilege enjoyed by the richest is that of preparing an entertainment, and treating the whole family at their own expences: but they never allow themselves to taste a bit of any thing until an offering has been first made to their ancestors. This does not, however, excuse them from visiting the real tomb of their ancestors once or twice a year, generally in the month of April. At this time they pluck the weeds and bushes from around the tomb, renew their expressions of

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of grief, and conclude by placing upon it wine and provisions, which serve to dine their assistants.

119 Funeral ceremonies. The funeral ceremonies are considered by the Chinese as the most important of any. A few moments after a person has expired, he is dressed out in his richest attire, and adorned with every badge of his dignity; after which he is placed in the coffin. The preparation of a coffin, in which his body may be inclosed after death, is one of the chief objects of attention to a Chinese during his life, and great expence is often thrown out upon it; insomuch that the poor will give all they are worth, and the rich expend a thousand crowns, nay, a son will sell himself for a slave in order to purchase a coffin for his father. Sometimes the coffin, when purchased with all this labour and expence, will remain twenty years useless in the family, and is considered as the most valuable piece of furniture in his possession.

The manner of interment is as follows; First they sprinkle some lime in the bottom of the coffin; then they lay the body in it, taking care to place the head on a pillow, and to add a great deal of cotton that it may remain more steady, and be prevented from shaking. In this manner the body remains exposed seven days; but the time may be reduced to three, if any weighty reason makes it necessary; and, during this interval, all the relations and friends, who are purposely invited, come and pay their respects to the deceased, the nearest relations remaining in the house. The coffin is exposed in the hall of ceremony, which is then hung with white, but some pieces of black or violet coloured silk are here and there interspersed, as well as some other ornaments of mourning. Before the coffin is placed a table, on which stands the image of the deceased, or a carved ornament inscribed with his name: and these are always accompanied with flowers, perfumes, and lighted wax candles.

In the mean time those who enter the hall are accustomed to salute the deceased as if he were still in life. They prostrate themselves before the table, and knock their foreheads several times against the earth; after which they place on the table some perfumes and wax candles provided for the purpose. The salutation which they have made to the deceased is returned by the eldest son accompanied by his brothers. The latter come forth from behind a curtain, which hangs on one side of the coffin, creeping along the ground until they reach the spot where those stand whom they are going to salute; after which, without rising up, they return to the place from whence they came. The women are also concealed behind the same curtain, from whence they every now and then send forth dismal cries.

After a number of ceremonies and invitations, the funeral procession at last commences. A troop of men march in a file, carrying different figures made of paste-board, and representing slaves, lions, tigers, horses, &c. Others follow, marching in two files; some of which carry standards, some flags or censers filled with perfumes; while melancholy and plaintive airs are played by others on different musical instruments. These musicians immediately precede the coffin, which is covered with a canopy, in form of a dome, of violet-coloured silk: its four corners are ornamented with tufts of white silk very neatly embroidered, and covered at the top with net-work. The coffin is placed on the bottom of this machine, and is carried by 64 men. The eldest son, clothed in a frock of canvas, having his body bent and leaning on a staff, follows near the coffin; and behind him his brothers and nephews, but none of them clothed in canvas. Then come the relations and friends, all clad in mourning, and followed by a great number of chairs covered with white stuff, which contain the wives and female slaves of the deceased. These make great show of sorrow by their doleful cries; but M. Grosier observes, that in spite of all they can do, the lamentations of the Chinese are so methodical, that an European would be apt to conclude that they were the effects of art rather than the natural effusions of a mind agitated and oppressed with grief. When they arrive at the burying place, the coffin is deposited in a tomb appropriated for it, not far from which there are tables arranged in different halls, and on which the assistants are entertained with great splendour. The entertainment is sometimes followed by fresh marks of homage to the corpse; but these are often changed into thanks to the eldest son; who, however, answers only by signs. But if the deceased was a grandee of the empire, a certain number of his relations never leave the tomb for a month or two. There they reside in apartments purposely provided for them, and every day renew their marks of grief in company with the children of the deceased. The magnificence of these funeral ceremonies is proportioned to the wealth or dignity of the deceased. That of one of the brothers of the emperor was attended by 16,000 people, each of whom had a particular office assigned him relating to the ceremony.

120 Mourning. Mourning continues in China for three years; and during all this time they are obliged to abstain from the use of flesh and wine; nor can they assist at any entertainment of ceremony, or attend any public assembly. At first they are not even permitted to go abroad; and when they do so, they are carried in a chair covered with a white cloth. Sometimes the filial piety of the Chinese is carried to such a length, that they preserve the bodies of their deceased fathers in their houses for three or four years; and those who do so impose also upon themselves a great number of other duties, using no other seat during the day but a stool covered with white serge, and no other bed but a plain mat made of reeds, which is placed near the coffin.

121 Diversions of hunting and fishing. According to M Grosier, the only diversions of the Chinese are those of hunting and fishing, dancing not being practised, and gaming forbidden by law. Fishing is considered by them rather as an object of commerce and industry than amusement. They catch fish by various methods; using nets in their great fisheries, but lines in the private. In certain provinces also they use a certain kind of bird, whose plumage greatly resembles that of a raven, but with a much longer bill, very sharp and hooked. This method of fishing is practised in boats, of which great numbers may be seen on the river about sun-rising, with the fishing-birds perched on their prows. These birds are taught to catch fish almost in the same manner that dogs pursue game. The fishermen, after making several turns with their boats, beat the water strongly with one of their oars. This serves as a signal to the birds, who instantly plunge into the water, and diving, swallow as many

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small fish as they can, repairing immediately afterwards to the boat, and carrying a large one by the middle in their bill. The small ones are prevented from passing into the stomach by a ring placed on purpose to confine its gullet: and thus the fisherman by stroaking its neck with the head downwards, makes the bird disgorge all those small fish it has swallowed. When they have done fishing, the rings are taken off, and the birds allowed to feed. When the fish happens to be too large for a single bird, the others have sagacity enough to assist it; one taking it by the tail, another by the head, &c. and thus they transport it to their master.

Another method of fishing, practised only in China, is as follows: They nail a board, about two feet in breadth, which is covered with a white shining kind of varnish, upon the edges of a long narrow boat, from one end to the other. This board is placed in such a manner as to slope almost imperceptibly to the water. It is used only in the night-time, and is always turned towards the moon, that the reflection of light from the luminary may increase the splendor of the varnish. The fish, in sporting, often mistake this varnished board for water; and endeavouring to throw themselves into it, fall into the boat.

The soldiers have a particular method of fishing with a bow and an arrow; the latter of which is fixed to the bow by a string, both to prevent it from being lost, and to enable them to draw out the fish which the arrow has pierced: others make use of tridents to catch large fish which are sometimes found in the mud.

Besides these diversions, the Chinese have some strolling players, but no regular theatres; they have likewise musicians and singers, but no operas, or indeed any public spectacle worthy of notice.

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Of the Chinese language.

The language of the Chinese is not only very ancient, but, in M. Grosier's opinion, is still spoken as in the most early ages without any variation. His reasons for this opinion are, 1. We do not perceive in history, nor even in the most fabulous traditions, a single fact tending to occasion any doubt of the language spoken by the ancient Chinese being different from that used at present. 2. China has never changed its inhabitants; and if revolutions have occasioned any mixture of new languages, it appears that the ancient language has always been predominant, and that the new settlers have learned and spoken it, as the Marchew Tartars after their conquest. 3. The most intelligent and discerning of the literati agree, that the first chapters of the *Chou-king* were written under the reign of Yao 2300 years before Christ; and in these, several speeches of the first emperors are related word for word; and it is not probable that the language of these princes was different from that of the historian. 4. A compliment paid to Yao by one of his subjects, with the answer of that prince, are still preserved, as well as two songs composed under the same reign. 5. The most ancient inscriptions in China are all in the language spoken throughout the empire at this day. 7. The Chinese have borrowed nothing from other nations; and their attachment to their own customs, and to antiquity, must undoubtedly be very unfavourable to any innovation. The language spoken by the vulgar, indeed, must have undergone some changes; but these may be accounted trivial, affecting only the pronunciation; which indeed appears to be varied in some few instances. It is certain, however, that the Chinese players act theatrical pieces which were written 1000 years ago, and that these are still understood throughout the empire.

The language of China has no alphabet; all the words which compose it consist of one syllable only, and are very few in number. These always remain the same, and continue monosyllables even when two are joined together, being united in the same manner as the French words *bon* and *jour* are united to form *bon-jour*. These monosyllables never form but one sound. When written by an European, they begin with the letters *ch*, *tch*, *f*, *g*, or *j*, *i*, *h*, *l*, *m*, *n*, *g*, *ng*, *p*, *s*, *ts*, *v*, *ou*; the final letters being *a*, *e*, *i*, *o*, *oi*, *ou*, *u*, *l*, *n*, *gn*. The middle of Chinese words consists of vowels and consonants producing only one sound, and pronounced always as monosyllables. The whole primary words of the language are in number only about 330, though some dictionaries make them 484. The sense of these words, however, is varied by the accents and changes of the voice in pronouncing them almost *ad infinitum*. Two principal accents are known in China; the *ping*, that is *even*, without elevating or depressing the voice. This is divided into *tsing*, *clear*, and *tcho*, *obscure*; or rather *open* and *mute*. The accent *tse* is subdivided into *tchang*, sharp, *kiu*, grave, and *jou* re-entering. The tone is *chang* when one raises the voice at the end of a word, as when the negative *no* is pronounced with great emphasis and force; it is *kiu* when one depresses the voice with an air of timidity. When the accent is *jou*, the voice is drawn back as it were into the throat; and the aspiration which takes place on certain words beginning with the letters *c*, *k*, *p*, *t*, still adds to these varieties.

By these differences in pronunciation the signification of the words is totally changed: thus the word *tchu* pronounced by lengthening the *u*, and with a clear tone of voice, signifies master or lord: if it is pronounced in an uniform tone by lengthening the *u*, it signifies *hog*: when pronounced lightly, and with rapidity, it signifies *kitchen*; and when articulated with a strong voice depressed towards the end, it signifies a *pillar*.

By the conjunction and modification of these different monosyllables, a Chinese can express every thing he has occasion for; and it may be easily seen what variety must result from this art of multiplying words. The Chinese language therefore has words expressive of the smallest variation of circumstance, and which cannot be expressed in the European languages without a circumlocution. Thus, instead of the five words, calf, bull, ox, heifer, cow, every time that a cow has a calf she acquires a new name in the language of this empire; and still another when she becomes barren. An ox fed for sacrifice has a particular name, which is changed when he goes to the altar. In like manner, a whole dictionary might be composed of the words that are employed to express the different parts of the emperor's palace, and those that are in a manner consecrated to it; others being employed when the palaces of princes or mandarins are spoken of. Thus the number of their characters are augmented beyond all bounds, so that the greater part of their literati spend all their lives in studying them.

In the Chinese there are four different languages. 1. The *Kou-ouen*, or classical language. This is not spoken

China. ſpoken at preſent, though it is generally believed to have been the language of the early ages. It is ſo laconic, and the ideas are ſo crowded, that it is very difficult to be underſtood; however, the literati, who can read and underſtand it, are much delighted with it. 2. The *Ouen-tchang* is the language uſed in compoſitions where a noble and elevated ſtyle is requiſite. It is never ſpoken, but certain ſentences and complimentary expreſſions are ſometimes borrowed from it. It approaches near to the laconic brevity and majeſtic ſublimity of the *Kou-ouen*, and is equally proper for every kind of ſubject, excepting only the ambiguities of metaphyſics, and the formal rugged diction uſed in treating of the abſtract ſciences.

3. The *Kouan-ha* is the language of the court, of people in office, and of the literati. It admits of ſynonymous expreſſions to moderate the brevity of monoſyllables; of pronouns and relatives; prepoſitions, adverbs, and particles; to ſupply the want of caſes, moods, tenſes, and numbers, which have place in other languages.

4. *Hiang-tan* is a kind of corrupted language, or provincial dialect, ſpoken by the lower claſſes in China; and of which every province, city, and almoſt every village, has its own. Beſides the ſenſe of the words, which is changed in a great variety of places, they are ſo altered by diverſity of pronunciation as to be almoſt unintelligible.

123 Chineſe writing.

There are five kinds of writing mentioned by the Chineſe literati; the moſt modern of which is a method of tracing out the characters with a pencil. This is difficult, and requires much experience; at any rate, it disfigures the characters greatly, and is therefore only uſed in the preſcriptions of phyſicians, prefaces to books, and inſcriptions of fancy. The tracing of characters with neatneſs and accuracy, however, as we have already had occaſion to obſerve, is greatly admired in China. They are often preferred to the moſt elegant painting; and ſome will give a moſt exorbitant price for a page of an old book, if it happens to be neatly written. They pay particular attention to well-formed characters even in the moſt common books; and if any of the leaves happen to fall off, will replace them with the greateſt attention. To apply them to any vile purpoſe, tread them under foot, &c. would be reckoned an unpardonable violation of decency and politeneſs; nay, it often happens, that workmen, ſuch as maſons and joiners, dare not tear a printed leaf of paper fixed to the wall.

Punctuation was not formerly uſed in China, nor are points as yet employed in works of an elevated ſtyle, or ſuch as are to be preſented to the emperor.

124 Of their poetry.

Poetry is ſeldom any object of attention, though the taſte for it ſeems to be pretty general in China. Their verſification has its rules, and is no leſs difficult than that of other nations. Only the moſt harmonious, energetic, and pictureſque words, are to be employed, and they muſt always be uſed in the ſame ſenſe in which they were uſed by the ancients. Each verſe can contain only a certain number of words; all of which muſt be ranged according to the rules of quantity, and terminate in rhyme. The number of verſes in a ſtrophe is not determined; but they muſt be uniform, and preſent the ſame diſtribution of rhymes. The ſmall number of poetical expreſſions contained in the Chineſe language has rendered it neceſſary to extend the poetical licence to a great length in this reſpect. The Chineſe poets are allowed to employ a blank verſe in every four. They are acquainted with moſt kinds of poetry in uſe amongus. They have ſtanzas, odes, elegies, idylls, eclogues, epigrams, ſatires, and even *bouts rimes*. The common people have alſo ballads and ſongs peculiar to themſelves. Some of the moſt diſtinguiſhed of the literati have even thought it of importance enough to turn the moſt celebrated maxims of morality, with the rules of civility, into verſe. Their poetry is ſeldom diſgraced by any kind of obſcenity; and indeed any ſuch thing would be ſeverely puniſhed by government. That ſevere attention with which every thing tending to corrupt the morals is watched in China, prohibits not only poems of this kind, but likewiſe romances of all ſorts. The police, however, permits ſuch novels as have an uſeful tendency, and in which nothing is introduced prejudicial to ſound morality. Every author who writes againſt government is puniſhed with death, as well as all thoſe who have had any hand in the printing or diſtribution of his works.

125 Chineſe paper.

The art of making paper and printing have been long known among the Chineſe. That kind of paper now in uſe was firſt manufactured about 105 years before the Chriſtian æra. Before that period they uſed cloth, and various kinds of ſilk ſtuff, inſtead of paper; and to this day they ſtill preſerve a cuſtom of writing the praiſes of the dead upon large pieces of ſilk, which are ſuſpended on one ſide of the coffin, and carried in funeral proceſſions; and of ornamenting their apartments with maxims and moral ſentences written in the ſame manner. In ages ſtill more early, they wrote with a kind of ſtyle upon pieces of bamboo, or even upon plates of metal. The firſt paper was invented by a mandarin. He took the bark of trees, hemp, and old pieces of ſilk-ſtuff, boiling them together until they were reduced to a kind of paſte, of which he formed his paper; which by degrees was brought to perfection, and the art of whitening and giving it a luſtre found out. A great number of different ſubſtances are now uſed in this empire for making paper; ſuch as the bamboo, reed, the cotton ſhrub, the bark of the plant called *kou-chu*, and of the mulberry tree; hemp, the ſtraw of wheat and rice, parchment, the cods of the ſilk worm, and ſeveral other ſubſtances unknown in Europe. In this manufacture the bark of trees and ſhrubs is uſed, and the woody ſubſtance of the bamboo and cotton tree, after it has been macerated and reduced to a thin paſte. Moſt of the Chineſe paper, however, is attended with the diſadvantage of being very ſuſceptible of moiſture, readily attracts the duſt, and worms inſenſibly get into it: to prevent which inconveniences, it is neceſſary to beat the books often, and expoſe them to the ſun. That made of cotton is the pretttieſt, and moſt uſed of any. All of them, however, are much ſofter and ſmoother than ours; which is abſolutely neceſſary for their method of writing with a pencil, in order that it may run with freedom, which it could not do upon ours. It is formed into ſheets of an enormous ſize; ſo that it would be no difficult matter to procure from the manufactories of this empire ſheets of paper 30 or 40 feet long.

126 Ink.

The Chineſe ink came originally from Corea; and it was not until the year 900, that they hit upon the method

thod of making it to perfection. The best is made in *Hoei-tcheou* in the province of *Kiangnan;* but its composition is a secret, which the workmen conceal not only from strangers, but from their fellow-citizens. When a Chinese has occasion to write, he places upon his table a piece of polished marble, having a cavity at one of its extremities to contain a little water. In this he dips the end of his cake of ink, and rubs it upon the smooth part of the marble; and as he presses more or less strongly, the liquor acquires a deeper or lighter tinge of black. When he has done writing, the stone is carefully washed; for it would be dishonoured by allowing the least spot to remain. The pencils used in writing are commonly made of the fur of a rabbit, and consequently very soft.

127
Their method of printing.

The Chinese method of printing is exceedingly different from ours; and indeed it would be in a manner impossible to have moveable types for such a number of characters as their language requires. The whole work which they intend to print is therefore engraved upon blocks of wood; and their method of proceeding is as follows. They first employ an excellent writer, who transcribes the whole upon very thin paper. The engraver glues each of the leaves of the manuscript upon a piece of plank made of any hard wood; he then traces over with a graver the strokes of the writing, carves out the characters in relief, and cuts down the intermediate part of the wood. Thus each page of a book requires a separate plank; and the excessive multiplication of these is no doubt a very great inconvenience, one chamber being scarce sufficient to preserve those employed for a single book. The advantages are, that the work is thus free from typographical errors, and the author has no occasion to correct the proofs. Thus also the booksellers in China have a decided advantage over those of Europe, as they are able by this method of printing to throw off copies according to their sale, without running the risk of being ruined by too large an addition. In this method the beauty of the work depends entirely upon the skill of the writer previously employed. The engravers are exceedingly dexterous, and imitate every stroke so exactly, that it is sometimes difficult to distinguish a printed work from one that is only written.

The method of printing in China is not by a press as in Europe, as neither their wooden planks nor their soft paper could sustain so much pressure. They first place the plank level, and then fix it in that position. The printer is provided with two brushes, and, with the hardest, daubs the plank with ink; and one daubing is sufficient for four or five leaves. After a leaf has been adjusted upon the plank, the workman takes the second brush, which is softer than the former, and of an oblong figure, and draws it gently over the paper, pressing it down a little, that it may receive the ink. The degree of pressure is to be regulated by the quantity of ink upon the plank: and in this manner one man is able to throw off almost 10,000 copies a-day. The ink used for printing is different from that formerly described, and which is used in writing. The leaves, on account of the thinness of the paper, are printed only upon one side; on which account each leaf of a book is double, so that the fold stands uppermost, and the opening is towards the back, where it is stitched. Hence the Chinese books are not cut on the edges, but on the back. They are generally bound in grey pasteboard, which is very neat; and those who wish to have them more elegantly done, get the pasteboard covered with satin, flowered taffety, and sometimes with gold and silver brocade. Their books are neither gilt nor coloured on the edges like ours.

128
Vast quantity of silk produced.

The art of manufacturing silk, according to the best authorities, was communicated by the Chinese to the Persians, and from them to the Greeks. The art has been known in this empire from the remotest antiquity; and the breeding of silk-worms and making of silk was one of the employments even of the empresses in very early ages.

The most beautiful silk in the whole empire is that of *Tche-kiang,* which is wrought by the manufactories of Nankin. From these are brought all the stuffs used by the emperor, and such as he distributes in presents to his nobility. A great number of excellent workmen are also drawn to the manufactories of Canton by the commerce with Europe and other parts of Asia. Here are manufactured ribbons, stockings, and buttons. A pair of silk stockings here cost little more than 6s. sterling.

The quantity of silk produced in China seems to be almost inexhaustible; the internal consumption alone being incredibly great, besides that which is exported in the commerce with Europe and the rest of Asia. In this empire all who possess a moderate fortune wear silk clothes; none but the lower class of people wearing cotton stuffs, which are commonly dyed blue. The principal stuffs manufactured by them are plain and flowered gauzes, of which they make summer dresses, damask of all colours; stripped and black satins; napped, flowered, striped, clouded, and pinked taffeties; crapes, brocades, plush, different kinds of velvet, and a multitude of other stuffs unknown in Europe. They make particular use of two kinds; one named *touan-tse,* a kind of satin much stronger, but, which has less lustre, than that of Europe; the other a kind of taffety, of which they make drawers and linings. It is woven exceedingly close, and is yet so pliable that it may be rumpled and rubbed between the hands without any crease; and even when washed like cotton-cloth, it loses very little of its lustre. They manufacture also a kind of gold brocades, but of such a slight nature, that they cannot be worn in clothes: they are fabricated by wrapping fine slips of gilt paper round the threads of silk.

129
Porcelain.

Porcelain is another great branch of Chinese manufacture, and employs a vast number of workmen. The finest is made in a village called *King-te-ching* in the province of *Kiang-si.* Manufactories have also been erected in the provinces of Fo-kien and Canton, but their produce is not esteemed, and one which the emperor caused to be erected at Peking, in order to be under his own inspection, miscarried entirely.

The Chinese divide their porcelain into several classes, according to its different degrees of fineness and beauty. The whole of the first is reserved for the use of the emperor, so that none of it ever comes into the hands of other persons, unless it happen to be cracked or otherwise damaged in such a manner as to be unworthy of being presented to the sovereign. Among that sent to the emperor, however, there is some porcelain of an in-

inferior quality, which he diſpoſes of in preſents. There is ſome doubt, therefore, whether any of the fineſt Chineſe porcelain was ever ſeen in Europe. Some value, however, is now put upon the European porcelain by the Chineſe themſelves.

130 Glaſs of little eſtimation.

The uſe of glaſs is very ancient in China, though it does not appear that great value was ever put upon this kind of ware, the art of manufacturing it having been frequently loſt and revived again in this empire. They greatly admire the workmanſhip of the European cryſtal, but prefer their own porcelain, which ſtands hot liquors, and is much leſs liable to be broken. The little eſtimation in which this ſubſtance was held, is even mentioned by their own writers in ſpeaking of the falſe pearls, mirrors and other toys which were made in former ages. The remembrance of a very large glaſs veſſel, however, which was made in 627, is ſtill preſerved; and of which it was ſaid that a mule could as eaſily enter it as a gnat could enter a pitcher. In order to tranſport this monſtrous veſſel from the place where it was manufactured to the emperor's palace, it was neceſſary to incloſe it in a net, the four corners of which were fixed to four carriages. The ſame indifference with regard to glaſs is ſtill entertained by the preſent emperors; however, a glaſs-houſe is eſtabliſhed at Peking, where a number of vaſes and other works are made; and theſe are ſo much the more difficult in the execution, as none of them are blown. This manufactory, as well as many others, is conſidered only as an appendage of the court, deſtined for the purpoſes of pomp and magnificence.

131 Medicine.

Moſt of the Chineſe medicine is abſolute quackery; their ſkill in anatomy is not only very limited, but mixed with ſuch a number of falſehoods, as render it in a manner abſolutely uſeleſs. Their materia medica conſiſts moſtly of herbs, of which tea is one. To this they aſcribe great and wonderful virtues, eſpecially if it has been gathered on any of the ſummits of a mountain called *Mong-chan*. The only thing regarding this ſcience, which merits any attention, is the method they are ſaid to poſſeſs of diſcovering whether a man has hanged or drowned himſelf, or had that violence committed upon him by others. In order to diſcover this, the body is firſt taken from the earth, and waſhed in vinegar. After this a large fire is kindled in a pit dug on purpoſe, ſix feet long, three wide, and the ſame depth. This fire is continually augmented, until the ſurrounding earth becomes as hot as an oven; the remaining fire is then taken out, a large quantity of wine is poured into it, and it is covered with a hurdle made of oſier twigs, upon which the body is ſtretched out at full length. A cloth is thrown over both in the form of an arch, in order that the ſteam of the wine may act upon it in every direction. At the end of two hours the cloth is taken off; and if any blows have been given, they then appear upon the body in whatever ſtate it may be. The Chineſe likewiſe aſſert, that if the blows given have been ſo ſevere as to occaſion death, this trial makes the marks appear upon the bones, though none of them ſhould be broken or apparently injured. The wine uſed in theſe trials is only a kind of beer made from rice and honey.

132 Method of diſcovering if a man has died a voluntary death.

133 Of their muſic.

With regard to the muſic of the Chineſe, we have the ſame ſtories related as of the Greeks and Egyptians, viz. that in former ages the muſicians could make brute animals leap at the ſound of their inſtruments. Our author, M. Groſier, indeed, does not quote any Chineſe author who aſſerts that the ancient muſic could make trees dance, or ſtones arrange themſelves into a city; but he quotes them, aſſerting, "that the muſicians could call down ſuperior ſpirits of every age from the etherial regions; raiſe up the manes of departed beings; inſpire men with a love of virtue; and lead them to the practice of their duty." Effects of this ſupernatural kind are attributed to the ſacred muſic by the inſpired writers; as in the caſe of Saul, out of whom an evil ſpirit departed at the ſound of David's harp; and of Eliſha, who was inſpired with the ſpirit of prophecy at the ſound of a muſical inſtrument. It is probable therefore, that the relations both of the Greeks and Chineſe are founded upon facts of this kind; and we cannot from thence infer, that the muſic of early ages was at all ſuperior to that which followed. According to thoſe who have employed much time in theſe reſearches, the ancient Chineſe were acquainted with the diviſion of the octave into twelve ſemitones; and that before the time of Pythagoras, or even Mercury himſelf; that the lyre of Pythagoras, his invention of the diatonic tetrachords, and the formation of his grand ſyſtem, were merely borrowed from the ancient Chineſe. In ſhort, it is maintained, that the Greeks, even Pythagoras himſelf, did nothing but apply to ſtrings that theory which the Chineſe had before formed, and applied to pipes.

At preſent the Chineſe are not acquainted with the uſe of our muſical notes; they have not that diverſity of ſigns which diſtinguiſh the different tones, and the gradual elevation or depreſſion of the voice, nor any thing to point out the various modifications of ſound to produce harmony. They have only a few characters to mark the principal notes; and all the airs they learn are repeated merely by rote. The emperor Kang-hi was therefore greatly aſtoniſhed at the facility with which an European could catch and remember an air the firſt time he heard it. In 1679 he ſent for Fathers Grimaldi and Pereira, to play ſome tunes on the harpſichord, of which they had before made him a preſent. He was greatly entertained with their muſic, but altogether aſtoniſhed when he found that F. Pereira could take down a Chineſe air while the muſicians were playing it, and then repeat the whole without omitting a ſingle note. Having made ſeveral trials of this kind in order to ſatisfy himſelf, he beſtowed the higheſt encomiums upon the European muſic, and the means furniſhed by it to facilitate and leſſen the labour of the memory. "I muſt confeſs (ſays he) that the European muſic is incomparable, and that the like of this F. Pereiri is not to be found in my whole kingdom."

The Chineſe have always diſtinguiſhed eight different ſounds; and they believe that nature, in order to produce theſe, formed eight different kinds of ſonorous bodies. The order in which they diſtribute theſe ſounds, and the inſtruments they have contrived to produce them, are, 1. The ſound of ſkin produced by drums. 2. That of ſtone produced by the *king*. 3. The ſound of metal by bells. 4. That of baked earth by the *huien*. 5. Of ſilk by the *kin* and *che*. 6. Of 134 Muſical inſtruments.

China.

wood by the *yu*, and *tchou*. 7. Of the bamboo by the *koan*, and different flutes. 8. That of a gourd by the *cheng*.

The drums were originally composed of a box made of baked earth, and covered at the extremities with the skin of some animal; but on account of the brittleness of baked earth, wood was soon substituted in its stead. Greater part of these instruments are shaped like our barrels, but some are cylindric.

The instruments formed of the sonorous stones are called *king*, distinguished into *tse-king* and *pien-king*. The *tse-king* consists only of one stone, and therefore produces only one note. The *pien-king* consists of 16 stones suspended together, and thus forming an instrument capable of producing all the tones admitted into the music of the ancient Chinese. They are cut into the form of a carpenter's square; their tone is flattened by diminishing their thickness, and is made sharper by abridging their length.

135 Bells of immense size.

The bells in China have always been made of a mixture of tin and copper. They are of different shapes, and those of the ancients were not round, but flatted, and in the lower part resembling a crescent. An instrument, corresponding to the *king* already mentioned, is composed of 16 bells of different sizes. Some of their bells used on public occasions are of enormous magnitudes. One at Peking is described as $13\frac{1}{2}$ feet in diameter, $12\frac{1}{2}$ in height, and 42 in circumference; the weight being upwards of 120,000 pounds. It is used for announcing the hours or watches of the night; and its sound, which is prodigiously loud and strong, has a most awful effect in the night-time, by reverberating round the walls and the echo of the surrounding country. There are several others likewise of a vast size in the same city; one of which deserves greatly to be admired on account of the beautiful characters with which it is covered: and which are as neat and perfect as if traced out by the hand of the finest writer, or formed by means of a stamp upon wax. F. le Comte tells us, that in all the cities of China there are bells for marking the hours and watches of the night. They generally divide the night into five watches, beginning at seven or eight in the evening. On the commencement of the first they give one stroke, which is repeated a moment after; and thus they continue for two hours till the beginning of the second: they then give two strokes, which are repeated at equal intervals till the beginning of the third watch; and thus they proceed to the fourth and fifth, always increasing the number of the strokes. For the same purpose also they use enormous drums, which they beat in a similar manner. F. Magaillans mentions one at Peking upwards of 40 feet in circumference.

The instrument called *huien*, which is made of baked earth is highly esteemed by the Chinese on account of its antiquity. It is distinguished into two kinds, the great and small; the former being of the size of a goose's egg; the latter of that of a hen's. It has six holes, and a seventh for the mouth.

The *kin* and *tche* have been known from the remotest antiquity. The kin has seven strings made of silk, and is distinguished into three kinds, differing only in size. The body is formed of a kind of wood varnished black, and its whole length about five feet five inches. The *che* is about nine feet in length, has 25 strings, and is divided into 25 kinds. F. Amiot assures us, that we have no instrument in Europe which deserves to be preferred to it.

The instruments which emit the sound of wood are the *tchou*, the *yu*, and the *tchoung-tou*. The first is shaped like a bushel, and is beat on the inside with a hammer; the second, which represents a tyger squatting, is made to sound by scraping its back gently with a rod; the third is a collection of twelve pieces of boards tied together, which are used for beating time, by holding them in the right hand, and knocking them gently against the palm of the left.

Many instruments are constructed of the bamboo. These consist of pipes joined together, or separate, and pierced with more or fewer holes. The principal of all these wind instruments is the *cheng*, which emits the sound of a gourd. This is formed by cutting off the neck of a gourd, and reserving only the lower part. To this a cover is fitted, having as many holes as are equal to the number of sounds required. In each of these holes a pipe made of bamboo is fixed, and shorter or longer according to the tone intended. The mouth of the instrument is formed of another pipe shaped like the neck of a goose; which is fixed to the gourd on one side, and serves to convey the air to all the pipes it contains. The ancient *cheng* varied in the number of their pipes; those used at present have only 13.

136 Chinese painting.

The painting of the Chinese is undoubtedly inferior to that of the Europeans, though we are not by any means to judge of the abilities of the painters of this empire by the performances which are brought to Europe. M. Grosier remarks, that the works of the eminent Chinese painters are never brought to Canton, because they cannot find purchasers among the European merchants. The latter delight only in obscene pictures, which are not permitted by government, nor indeed will any artist of character execute them, though they prevail upon some of the inferior daubers to gratify them in this respect. It seems, however, to be universally agreed, that the Chinese have no notion of correctness or perspective, and little knowledge of the proportions of the human body, though it cannot be denied that they excel in painting flowers and animals. In these they pride themselves in a scrupulously exact imitation of nature, insomuch that it is no uncommon thing to hear a painter ask his pupil how many scales there are between the head and tail of a carp.

Painting was formerly much esteemed in China, but has now fallen into disrepute on account of its political inutility. The cabinets and galleries of the emperor, however, are filled with European paintings, and the celebrated artists Castiglioni and Attiret were both employed; but their offer of erecting a school of painting was rejected, lest they should by this means revive the taste for that art which it had been formerly though prudent to suppress.

Painting in fresco was known in China long before the Christian aera; and, like the Grecians, the Chinese boast much of their celebrated painters of antiquity. Thus we are told of a door painted by Fan-hien, which was so perfect an imitation, that the people who entered the temple where it was attempted to go out by it, unless prevented by those who had seen it before.

The

The present emperor has in his park an European village painted in fresco, which produces the most agreeable deception. The remaining part of the wall represents a landscape and little hills, which are so happily blended with the distant mountains, that nothing can be conceived more agreeable. This was the production of Chinese painters, and executed from designs sketched out for them.

137 Engraving. Engraving in three, four, or five colours, is very ancient among the Chinese, and was known in this empire long before its discovery in Europe.

138 Sculpture. Sculpture is very little known in this empire; nor is there a single statue in any of the squares or public edifices of Peking, not even in the emperor's palace. The only real statues to be met with in the empire are those which, for the sake of ceremonious distinction, are used to ornament the avenues leading to the tombs of princes and men of great rank; or those that are placed near the emperor's coffin, and that of his sons and daughters in the interior part of the vault, where their remains are deposited.

139 Architecture. The Chinese architecture is entirely different from that of the Greeks or Romans: but nevertheless has certain proportions of its own, and a beauty peculiar to itself. The habitations of the emperor are real palaces, and announce in a striking manner the majesty and grandeur of the master who inhabits them. All the missionaries who had access to the inside of the emperor's palace at Peking, agreed, that if each of its parts, taken separately, does not afford so much delight to the eye as some pieces of the grand architecture of Europe, the whole presents a sight superior to any thing they had ever seen before. In the Chinese architecture, when a pillar is two feet diameter at the base, its height must be 14 feet: and by measures of this kind the height of every building is determined.

Almost all the houses and buildings in China are constructed of wood. One reason of this may be the dread of earthquakes; but, besides this, such buildings are rendered eligible by the heat and dampness of the southern provinces, and the excessive cold in the northern, which would render stone houses almost uninhabitable. Even at Peking, where the rains are but of short duration, it is found necessary to cover the small marble stair-cases belonging to the imperial palace with pieces of felt: the humidity of the air moistens and soaks into every thing. During winter the cold is so exceedingly severe, that no window can be opened to the north; and water continues constantly frozen to the depth of a foot and a half for more than three months. For the same reasons a variety of stories are not used in the Chinese buildings; as neither a second nor third story would be habitable during the great heats of summer or the rigorous cold of winter. Though Peking is situated in the northern part of the empire, the heat there, during the dog-days, is so intolerably scorching, that the police obliges tradesmen and shopkeepers to sleep in the open air in the piazzas of their houses, lest they should be stifled by retiring into their inner apartments. The habitations of people of rank, or of those of easy circumstances, generally consist of five large courts, inclosed with buildings on every side. The method of building with several stories was, however, followed for several centuries, when the court resided in the southern provinces; and the taste for this kind of building was carried to such an height, that immense edifices were erected from 150 to 200 feet in height, and the pavilions or towers at the extremities rose upwards of 300 feet. This kind of building, however, at length became disgusting; though, either to preserve the remembrance of it, or for the sake of variety, there are still some buildings to be seen several stories high in the palaces belonging to the emperor.

A multiplicity of bridges are rendered necessary in China by the vast number of canals and rivers which intersect the empire. Anciently, however, the Chinese bridges were much more ingenious as well as magnificent than they are at present. Some of them were so contrived that they could be erected in one day to supply the place of others which might happen to be broken down, or for other purposes. At that time they had bridges which derived their name from their figure; as *resembling the rainbow; draw-bridges, bridges to move with pullies, compass-bridge*, &c. with many others entirely unknown at present. The building of bridges indeed was once a luxurious folly of the emperors; so that they were multiplied from whim or caprice, without any necessity, and without use. Still, however, many of them are extremely beautiful and magnificent. The arches of some are very lofty and acute, with easy stairs on each side, the steps of which are not quite three inches in thickness, for the greater facility of ascending and descending: others have no arches, but are composed of large stones, sometimes 18 feet in length, placed transversely upon piles like planks. Some of these bridges are constructed of stone, marble, or brick; others of wood; and some are formed of a certain number of barks joined together by very strong iron chains. These are known by the name of floating bridges, and several of them are to be seen on the large rivers Kiang and Hoang-ho. 140 Bridges.

For several centuries the Chinese have made no progress in ship-building. Their vessels have neither mizen, bowsprit, nor top mast. They have only a main and fore-mast, to which is sometimes added a small top gallant-mast. The main-mast is placed almost in the same part of the deck as ours; but the fore-mast stands much farther forward. The latter is to the former in the proportion of two to three; and the main-mast is generally two-thirds of the length of the vessel. They use mats for sails, strengthening them with whole bamboos equal in length to the breadth of the sail, and extended across it at the distance of a foot from one another. Two pieces of wood are fixed to the top and bottom of the sail; the upper serves as a sail-yard; and the lower, which is about five or six inches in thickness, keeps the sail stretched when it is necessary to hoist or lower it. This kind of sail may be folded or unfolded like a screen. For caulking their vessels they do not use pitch, but a particular kind of gum mixed with lime, which forms a composition of such excellent quality, that one or two wells in the hold are sufficient to keep the vessel dry. They have not yet adopted the use of pumps, and therefore draw up the water with buckets. Their anchors are made of the hard wood called *iron-wood*, which they say is much superior, 141 Ship-building.

superior to the metal, because the latter sometimes bend, but the former never do.

The Chinese pretend to have been the first inventors of the mariner's compass, but seem to have little inclination to improve such an important machine: however, they are well acquainted with the art of manœuvring a vessel, and make excellent coasting pilots, though they are bad sailors in an open sea.

*China-Root*, in the materia medica, the root of a species of Smilax, brought both from the East and West Indies; and thence distinguished into oriental and occidental. Both sorts are longish, full of joints, of a pale-reddish colour, with no smell, and very little taste. The oriental, which is the most esteemed, is considerably harder and paler-coloured than the other. Such should be chosen as is fresh, close, heavy, and upon being chewed appears full of a fat unctuous juice. It is generally supposed to promote insensible perspiration and the urinary discharge, and by its unctuous quality to obtund acrimonious juices. China-root was first brought into Europe in the year 1535, and used as a specific against venereal and cutaneous disorders. With this view it was made use of for some time; but has long since given place to more powerful medicines.

*China-Ware*. See Porcelain.

CHINCA, a sea-port town of Peru in South America, situated in an extensive valley of the same name, in W. Long. 76. 0. S. Lat. 13. 0.

CHINCOUGH, a convulsive kind of cough to which children are generally subject. See Medicine-*Index*.

CHINESE, in general denotes any thing belonging to China, or its inhabitants.

*Chinese Swanpan*. See Swanpan.

CHINKAPIN. See Fagus.

CHINNOR, a musical instrument among the Hebrews, consisting of 32 chords. Kircher has given a figure of it, which is copied on Plate CXXXV.

CHINON, an ancient town of Tourain in France, remarkable for the death of Henry II. king of England, and for the birth of the famous Rabelais. It is seated on the river Vienne, in a fertile and pleasant country, in E. Long. 0. 18. N. Lat. 47. 2.

CHIO, or Chios, an Asiatic island lying near the coast of Natolia, opposite to the peninsula of Ionia. It was known to the ancients by the name of Æthalia, Macris, Pithyusa, &c. as well as that of Chios. According to Herodotus, the island of Chios was peopled originally from Ionia. It was at first governed by kings; but afterwards the government assumed a republican form, which by the direction of Isocrates was modelled after that of Athens. They were, however, soon enslaved by tyrants, and afterwards conquered by Cyrus king of Persia. They joined the other Grecians in the Ionian revolt; but were shamefully abandoned by the Samians, Lesbians, and others of their allies; so that they were again reduced under the yoke of the Persians, who treated them with the utmost severity. They continued subject to them till the battle of Mycale, when they were restored to their ancient liberty: this they enjoyed till the downfal of the Persian empire, when they became subject to the Macedonian princes. In the time of the emperor Vespasian the island was reduced to the form of a Roman province; but the inhabitants were allowed to live according to their own laws under the superintendance of a praetor. It is now subject to the Turks, and is called *Scio*. See that article.



CHIOCOCCA, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 48th order, *Aggregatae*. The corolla is funnel-shaped and equal; the berry unilocular, dispermous, inferior.

CHIONANTHUS, the Snow-drop or Fringe tree: A genus of the monogynia order, belonging to the diandria class of plants; and in the natural method ranking under the 44th order, *Sepiariae*. The corolla is quadrifid, with the segments very long; the fruit is a plum. There is but one species particularly described by botanists, viz. the *Virginica*. It is common in Virginia and South Carolina, where it grows by the sides of rivulets. It rises to the height of ten feet; the leaves are as large as those of the laurel, but much thinner. The flowers come out in May, and are of a pure white; from whence it has the name of the *snow-drop tree*. They hang down in large branches, and are cut into narrow segments; from which it has got its other name of the *fringe-tree*. After the flowers are fallen off, the fruit appears, which grows to the size of a sloe, having a stone in the middle. The plants are propagated, in Britain, from seeds sown on a hot-bed, and kept in a stove. Some have been raised from layers; but this method is very precarious, and therefore the other is to be preferred. The seeds are procured from America, for they never come to perfection in Britain.

CHIONE, in fabulous history, was daughter of Daedalion, of whom Apollo and Mercury became enamoured. To enjoy her company, Mercury lulled her to sleep with his caduceus; and Apollo, in the night, under the form of an old woman, obtained the same favours as Mercury. From this embrace Chione became mother of Philammon and Autolycus; the former of whom, as being son of Apollo, became an excellent musician; and the latter was equally notorious for his robberies, of which his father Mercury was the patron. Chione grew so proud of her commerce with the gods, that she even preferred her beauty to that of Juno; for which impiety she was killed by the goddess and changed into a hawk.——Another of the same name was daughter of Boreas and Orithyia, who had Eumolphus by Neptune. She threw her son into the sea; but he was preserved by his father.

CHIOS. See Chio and Scio.

CHIOURLIC, an ancient town of Turkey in Europe, and in Romania, with a see of a Greek bishop. It is seated on a river of the same name, in E. Long. 7. 47. N. Lat. 41. 18.

CHIOZZO, an ancient and handsome town of Italy, in the territory of Venice, and in a small Island, near the Lagunes, with a podesta, a bishop's see, and a harbour defended by a fort. E. Long. 12. 23. N. Lat. 45. 17.

CHIPPENHAM, a town of Wiltshire, seated on the river Avon. It is a good thoroughfare town; has a handsome stone-bridge over the river, consisting of 16 arches; and sends two members to parliament.

There

Chipping. There is here a manufacture of the beſt ſuperfine woollen cloth in England. W. Long. 2. 12. N. Lat. 51. 25.

CHIPPING, a phraſe uſed by the potters and china-men to expreſs that common accident both of our own ſtone and earthen ware, and the porcelain of China, the flying off of ſmall pieces, or breaking at the edges. Our earthen wares are particularly ſubject to this, and are always ſpoiled by it before any other flaw appears in them. Our ſtone-wares eſcape it better than theſe; but not ſo well as the porcelain of China, which is leſs ſubject to it than any other manufacture in the world. The method by which the Chineſe defend their ware from this accident, is this: They carefully burn ſome ſmall bamboo canes to a ſort of charcoal, which is very light, and very black; this they reduce to a fine powder, and then mix it into a thin paſte, with ſome of the varniſh which they uſe for their ware: they next take the veſſels when dried, and not yet baked, to the wheel; and turning them ſoftly round, they, with a pencil dipt in this paſte, cover the whole circumference with a thin coat of it; after this, the veſſel is again dried; and the border made with this paſte appears of a pale greyiſh colour when it is thoroughly dry. They work on it afterwards in the common way, covering both this edge and the reſt of the veſſel with the common varniſh. When the whole is baked on, the colour given by the aſhes diſappears, and the edges are as white as any other part; only when the baking has not been ſufficient, or the edges have not been covered with the ſecond varniſhing, we ſometimes find a duſky edge, as in ſome of the ordinary thick tea-cups. It may be a great advantage to the Engliſh manufactures to attempt ſomething of this kind. The willow is known to make a very light and black charcoal; but the elder, though a thing ſeldom uſed, greatly exceeds it. The young green ſhoots of this ſhrub, which are almoſt all pith, make the lighteſt and the blackeſt of all charcoal; this readily mixes with any liquid, and might be eaſily uſed in the ſame way that the Chineſe uſe the charcoal of the bamboo cane, which is a light hollow vegetable, more reſembling the elder ſhoots than any other Engliſh plant. It is no wonder that the fixed ſalt and oil contained in this charcoal ſhould be able to penetrate the yet raw edges of the ware, and to give them in the ſubſequent baking a ſomewhat different degree of vitrification from the other parts of the veſſel; which, though, if given to the whole, it might take off from the true ſemivitrified ſtate of that ware, yet at the edges is not to be regarded, and only ſerves to defend them from common accidents, and keep them entire. The Chineſe uſe two cautions in this application: the firſt in the preparation; the ſecond in the laying it on. They prepare the bamboo canes for burning into charcoal, by peeling off the rind. This might eaſily be done with the elder ſhoots, which are ſo ſucculent, that the bark ſtrips off with a touch. The Chineſe ſay, that if this is not done with their bamboo, the edges touched with the paſte will burſt in the baking: this does not ſeem indeed very probable; but the charcoal will certainly be lighter made from the peeled ſticks, and this is a known advantage. The other caution is, never to touch the veſſel with hands that have any greaſy or fatty ſubſtance about them; for if this is done, they always find the veſſel crack in that place.

2

Chirograph ‖ Chiron.

CHIROGRAPH, was anciently a deed which, requiring a counterpart, was engroſſed twice on the ſame piece of parchment, counterwiſe; leaving a ſpace between, wherein was written CHIROGRAPH; through the middle whereof the parchment was cut, ſometimes ſtraight, ſometimes indentedly; and a moiety given to each of the parties. This was afterwards called *dividenda*, and *chartæ diviſæ;* and was the ſame with what we now call *charter-party*. See CHARTER-*Party*. The firſt uſe of theſe chirographs, in Britain, was in the time of Henry III.

CHIROGRAPH was alſo anciently uſed for a fine; and the manner of engroſſing the fines, and cutting the parchment in two pieces, is ſtill retained in England, in the office called the *chirographer's office*.

CHIROGRAPHER *of* FINES, an officer in the common pleas, in England, who engroſſes FINES acknowledged in that court into a perpetual record (after they have been examined, and paſſed by other officers), and writes and delivers the indentures thereof to the party. He makes two indentures; one for the buyer, the other for the ſeller; and a third indented piece, containing the effect of the fine, and called *the foot of the fine;* and delivers it to the *cuſtos brevium*.—The ſame officer alſo, or his deputy, proclaims all fines in court every term, and indorſes the proclamations on the backſide of the foot; keeping, withal, the writ of covenant, and the note of the fine.

CHIROMANCY, a ſpecies of divination drawn from the lines and lineaments of a perſon's hand; by which means, it is pretended, the diſpoſitions may be diſcovered. See DIVINATION, nº 9.

CHIRON, a famous perſonage of antiquity; ſtyled by Plutarch, in his dialogue on muſic, "*The wiſe Centaur.*" Sir Iſaac Newton places his birth in the firſt age after Deucalion's deluge, commonly called the *Golden Age;* and adds, that he formed the conſtellations for the uſe of the Argonauts, when he was 88 years old; for he was a practical aſtronomer, as well as his daughter Hippo: he may, therefore, be ſaid to have flouriſhed in the earlieſt ages of Greece, as he preceded the conqueſt of the Golden Fleece, and the Trojan war. He is generally called the ſon of Saturn and Phillyra; and is ſaid to have been born in Theſſaly among the CENTAURS, who were the firſt Greeks that had acquired the art of breaking and riding horſes: whence the poets, painters, and ſculptors, have repreſented them as a compound of man and horſe; and perhaps it was at firſt imagined by the Greeks, as well as the Americans, when they firſt ſaw cavalry, that the horſe and the rider conſtituted the ſame animal.

Chiron was repreſented by the ancients as one of the firſt inventors of medicine, botany, and *chirurgery;* a word which ſome etymologiſts have derived from his name. He inhabited a grotto or cave in the foot of Mount Pelion, which, from his wiſdom and great knowledge of all kinds, became the moſt famous and frequented ſchool throughout Greece. Almoſt all the heroes of his time were fond of receiving his inſtructions; and Xenophon, who enumerates them, names the following illuſtrious perſonages among his diſciples: Cephalus, Æſculapius, Melanion, Neſtor, Amphiaraus, *Burney's Hiſt. of Muſic.*

phiaraus, Peleus, Telamon, Meleager, Theſeus, Hippolitus, Palamedes, Ulyſſes, Mneſtheus, Diomedes, Caſtor and Pollux, Machaon and Podalirius, Antilochus, Æneas, and Achilles. From this catalogue it appears, that Chiron frequently inſtructed both fathers and ſons; and Xenophon has given a ſhort eulogium on each, which may be read in his works, and which redounds to the honour of the preceptor. The Greek hiſtorian, however, has omitted naming ſeveral of his ſcholars, ſuch as Bacchus, Phœnix, Cocytus, Aryſtæus, Jaſon, and his ſon Medeus, Ajax, and Proteſilaus. Of theſe we ſhall only take notice of ſuch as intereſt Chiron more particularly. It is pretended that the Grecian Bacchus was the favourite ſcholar of the Centaur; and that he learned of this maſter the revels, orgies, bacchanalia, and other ceremonies of his worſhip. According to Plutarch, it was likewiſe at the ſchool of Chiron that Hercules ſtudied muſic, medicine, and juſtice; though Diodorus Siculus tells us, that Linus was the muſic-maſter of this hero. But among all the heroes, who have been diſciples of this Centaur, no one reflected ſo much honour upon him as Achilles, whoſe renown he in ſome meaſure ſhared; and to whoſe education he in a particular manner attended, being his grandfather by the mother's ſide. Apollodorus tells us, that the ſtudy of muſic employed a conſiderable part of the time which he beſtowed upon his young pupil, as an incitement to virtuous actions, and a bridle to the impetuoſity of his temper. One of the beſt remains of antique painting now exiſting, is a picture upon this ſubject, dug out of the ruins of Herculaneum, in which Chiron is teaching the young Achilles to play on the lyre. The death of this philoſophic muſician was occaſioned, at an extreme old age, by an accidental wound in the knee with a poiſoned arrow, ſhot by his ſcholar Hercules, at another. He was placed after his death by Muſæus among the conſtellations, through reſpect for his virtues, and in gratitude for the great ſervices which he had rendered the people of Greece. Sir Iſaac Newton ſays*, in proof of the conſtellations being formed by Chiron and Muſæus for the uſe and honour of the Argonauts, that nothing later than the expedition was delineated on the ſphere; according to the ſame author, Chiron lived till after the Argonautic expedition, in which he had two grandſons. The ancients have not failed to attribute to him ſeveral writings; among which, according to Suidas, are *precepts*, ὑποθηκας, in verſe, compoſed for the uſe of Achilles, and a medicinal treatiſe on the *diſeaſes incident to horſes* and other quadrupeds, ἱππιατρικον; the lexicographer even pretends, that it is from this work the Centaur derived his name. Fabricius gives a liſt of the works attributed to Chiron, and diſcuſſes the claims which have been made for others to the ſame writings; and in vol. xiii. he gives him a diſtinguiſhed place in his catalogue of ancient phyſicians.

* Chronol. p. 151.

CHIRONIA, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 20th order, *Rotaceæ*. The corolla is wheel-ſhaped; the piſtil declining downwards; the ſtamina placed in the tube of the corolla; the antheræ in their laſt ſtage ſpiral; the ſeed-caſe bilocular. There are eight ſpecies, of which the *fruteſcens* is the moſt remarkable. It is a native of the cape of Good Hope. The root is fibrous, and ſpreads near the ſurface of the ground. The ſtalks are round, and inclining to be ligneous, but are of a very ſoft texture; theſe riſe from two to three feet high, ſending out ſeveral branches which grow erect, and are garniſhed with ſucculent leaves an inch or more in length, and about an eighth of an inch in breadth. At the end of each ſhoot the flowers are produced, which are tubulous, and ſpread open at the top; they are of a bright red colour; and when there are a large number of flowers open on the ſame plant, they make a fine appearance. The flowers are produced from June to autumn; and the ſeeds ripen in October. The plants are propagated by ſeeds, which muſt be ſown in pots filled with light ſandy earth, and plunged in a moderate hot-bed. In ſummer they may be inured to the open air; but muſt always be ſheltered in winter.



CHIRONOMY, in antiquity, the art of repreſenting any paſt tranſaction by the geſtures of the body, more eſpecially by the motions of the hands: this made a part of liberal education; it had the approbation of Socrates, and was ranked by Plato among the political virtues.

CHIROTONY, among eccleſiaſtical writers, denotes the impoſition of hands uſed in conferring prieſtly orders. However, it is proper to remark, that chirotony was a method of electing magiſtrates by holdin up the hands.

CHIRURGEON, or SURGEON. See SURGEON.

CHIRURGERY. See SURGERY.

CHISLEY-LAND, in agriculture, a ſoil of a middle nature between ſandy and clayey land, with a large admixture of pebbles.

CHISON, KISON, or KISSON, (Judges iv. and v.), a river of Galilee; ſaid to riſe in mount Tabor, to run by the town of Naim, and to fall into the Mediterranean between mount Carmel and Ptolemais, 1 Kings xviii. 40.

CHISSEL, or CHISEL, an inſtrument much uſed in ſculpture, maſonry, joinery, carpentry, &c.

There are chiſſels of different kinds; though their chief difference lies in their different ſize and ſtrength, as being all made of ſteel well ſharpened and tempered: but they have different names, according to the different uſes to which they are applied.—The chiſſels uſed in carpentry and joinery are, 1. The former; which is uſed firſt of all before the paring-chiſſel, and juſt after the work is ſcribed. 2. The paring-chiſſel; which has a fine ſmooth edge, and is uſed to pare off or ſmooth the irregularities which the former makes. This is not ſtruck with a mallet as the former is, but is preſſed with the ſhoulder of the workman. 3. Skew-former: this is uſed for cleanſing acute angles with the point or corner of its narrow edge. 4. The mortiſe-chiſſel; which is narrow, but very thick and ſtrong, to endure hard blows, and it is cut to a very broad baſil. Its uſe is to cut deep ſquare holes in the wood for mortiſes. 5. The gouge, which is a chiſſel with a round edge; one ſide whereof ſerves to prepare the way for an augre, and the other to cut ſuch wood as is to be rounded, hollowed, &c. 6. Socket-chiſſels, which are chiefly uſed by carpenters, &c. have their ſhank made with a hollow ſocket at top, to receive a ſtrong wooden ſprig, fitted into it with a ſhoulder. Theſe chiſſels are diſtinguiſhed, according to the breadth of the blade, into half-inch chiſſels, three quarters of an inch chiſſels, &c. 7. Ripping-chiſſels; which is a ſocket-chiſſel of an inch broad, having a blunt edge, with no baſil to it. Its uſe is to rip or tear two pieces of wood aſunder, by forcing in the blunt edge between them.

CHITON, in zoology, a genus of the order of vermes teſtaceæ. The name *chiton* is from χιτων, *Lorica*, a coat of mail. The ſhell is plated, and conſiſts of many parts lying upon each other tranſverſely: the inhabitant is a ſpecies of the DORIS. They are common on the ſhores of Scarborough, Aberdeen, and Lochbroom. See ſeveral ſpecies repreſented of their natural ſize on Plate CXXXVIII.

CHITTIM (anc. geog.), according to Le Clerc, Calmet, and others, was the ſame with Macedonia, peopled by Kittim the ſon of Javan and grandſon of Noah.

CHITTRICK's MEDICINE FOR THE STONE. This medicine was ſome years ago kept as a ſecret, and had great reputation as a lithontriptic, which indeed in many caſes it ſeems to deſerve. It was diſcovered by Dr Blackrie, to be no other than ſoap-lye; and the following receipt for uſing it was procured by General Dunbar: "Take one tea-ſpoonful of the ſtrongeſt ſoap-lye, mixed in two table-ſpoonfuls of ſweet milk, an hour before breakfaſt and at going to bed. Before you take the medicine, take a ſup of pure milk, and immediately after you have ſwallowed the medicine take another. If you find this agrees with you for two or three days, you may add half as much more to the doſe."

1 Definition.

CHIVALRY, (from *cheval*, "a horſe);" an abſtract term, uſed to expreſs the peculiar privileges, obligations, and turn of mind, with all the other diſtinguiſhing characteriſtics of that order of men who flouriſhed in Europe in the dark ages, during the vigour of the feudal ſyſtems of government, under the name of *Knights*, or *Knights Errant*.

2 Difficulty of tracing the origin of chivalry.

To aſcertain the period at which the order ſprung up, and the circumſtances to which its origin was owing, is no eaſy taſk. In the hiſtory of ſociety, ſuch a multiplicity of collateral facts appear interwoven together, and cauſes and effects run into each other by a gradation ſo imperceptible; that it is exceedingly difficult, even for the niceſt eye, to diſcern cauſes from their immediate effects, or to diſtinguiſh to which among a number of collateral circumſtances the origin of any particular event is to be referred. The age to which we muſt look for the origin of chivalry was ſingularly rude and illiterate. Even the principal events of that period, emigrations, wars, and the eſtabliſhment of ſyſtems of laws and forms of government, have been but imperfectly, and in many inſtances unfaithfully, recorded. But the tranſactions which took place in the ordinary courſe of civil and domeſtic life, and which, though leſs ſtriking, muſt have always prepared the way for the more remarkable events, have been generally thought unworthy of tranſmiſſion to poſterity, and have very ſeldom found an hiſtorian. Add to theſe difficulties which oppoſe our reſearches on this ſubject, that the nations of Europe were in that age a mixed multitude, conſiſting of the aboriginal inhabitants, who, though either ſubdued by the Roman arms, or at leaſt compelled to retire to the woods and mountains, ſtill obſtinately retained their primitive manners and cuſtoms; Roman colonies, and ſuch of the original inhabitants of the countries in which theſe were eſtabliſhed, as had yielded not only to the arms of the Romans, but alſo to the influence of their laws, arts, and manners; and the barbarians, who proceeding from the northern regions of Aſia and Europe, the wilds of Scythia and Germany, diſſolved the fabric of the Roman empire, and made themſelves lords of Europe. Amid this confuſion of nations, inſtitutions and cuſtoms, it becomes almoſt impoſſible to trace any regular ſeries of cauſes and effects.

Yet as the hiſtory of that period is not entirely unknown to us, and the obſcure and imperfect records in which it is preſerved, while they commemorate the more remarkable events, throw a faint light on the cuſtoms, manners, and ordinary tranſactions of the age; we can at leaſt collect ſome circumſtances, which, if they did not of themſelves give riſe to the inſtitution of chivalry, muſt certainly have co-operated with others to that end. We may even be allowed, if we proceed with due diffidence and caution, to deduce, from a conſideration of the effect, ſome inferences concerning the cauſe; from thoſe particulars of its hiſtory which are known to us, we may venture to carry imagination backwards, under a proper reſtraint, to thoſe, which are hid under the darkneſs of a rude and illiterate age.

3 Diſtinction of ranks an eſſential part of the mechaniſm of ſociety.

Diſtinction of ranks appear to be eſſentially neceſſary to the exiſtence of civil order. Even in the ſimpleſt and rudeſt ſocial eſtabliſhments, we find not merely the natural diſtinctions of weak and ſtrong, young and old, parent and child, huſband and wife; theſe are always accompanied with others which owe their inſtitution to the invention of man, and the conſent, either tacit or formal, of the ſociety among whom they prevail. In peace and in war, ſuch diſtinctions are equally neceſſary: they conſtitute an eſſential and important part of the mechaniſm of ſociety.

4 The early pre-eminence of the military character.

One of the earlieſt artificial diſtinctions introduced among mankind, is that which ſeparates the bold and ſkilful warrior from thoſe whoſe feebleneſs of body and mind renders them unable to excel in dexterity, ſtratagem, or valour. Among rude nations, who are but imperfectly acquainted with the advantages of ſocial order, this diſtinction is more remarkably eminent than in any other ſtate of ſociety. The ferocity of the human character in ſuch a period produces almoſt continual hoſtilities among neighbouring tribes: the elements of nature, and the brute inhabitants of the foreſt, are not yet reduced to be ſubſervient to the will of man; and theſe, with other concomitant circumſtance, render the warrior, who is equally diſtinguiſhed by cunning and valour, more uſeful and reſpectable than any other character.

5 Subordinate diſtinctions of rank introduced into ſociety.

On the ſame principles, as the boundaries of ſociety are enlarged, and its form becomes more complex, the claſſes into which it is already diſtinguiſhed are again ſubdivided. The invention of arts, and the acquiſition of property, are the chief cauſes of theſe new diſtinctions which now ariſe among the orders of ſociety;

and

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and they extend their influence equally through the whole system. Difference of armour, and different modes of military discipline, produce distinction of orders among those who practise the arts of war; while other circumstances, originating from the same general causes, occasion similar changes to take place amid the scenes of peace.

6
The distinction introduced into the military order by the use of cavalry.

None of the new distinctions which are introduced among men, with respect to the discipline and conduct of war, in consequence of the acquisition of property and the invention of arts, is more remarkable than that occasioned by the use of horses in military expeditions, and the training of them to the evolutions of the military art. Fire-arms, it is true, give to those who are acquainted with them a greater superiority over those to whom their use is unknown than what the horseman possesses over him who fights on foot. But the use of fire-arms is of such importance in war, and the expence attending it so inconsiderable, that wherever these have been introduced, they have seldom been confined to one particular order in an army; and therefore they produce indeed a remarkable, though transient, distinction among different nations; but establish no permanent distinctions in the armies of any one nation. But to maintain a horse, to equip him with costly furniture, to manage him with dexterity and vigour, are circumstances which have invariably produced a standing and conspicuous distinction among the military order, wherever bodies of cavalry have been formed. The Roman *equites*, who, though they became at length a body of usurers and farmers-general, were originally the only body of cavalry employed by the state, occupied a respectable rank between the senators and the plebeians; and the elegance and humanity of their manners were suitable to their rank. In ancient Greece, and in the celebrated monarchies of Asia, the same distinction prevailed at a similar period.

7
Military distinctions among the ancient Germans.

Since the circumstances and principles on which this distinction depends are not such as must be confined in their influence to one particular nation, or one region of the globe, we may hope to trace their effects among the savage warriors of Scythia and Germany, as well as among the Greeks or Romans. From the valuable treatise of Tacitus *de moribus Germanorum*, we learn, that among the German warriors a distinction somewhat of this nature *did* actually subsist; not so much indeed a distinction between the warrior who fought on horseback and those who fought on foot, as between those whom vigour of body and energy of mind enabled to brave all the dangers of war, and such as, from the imbecility of youth, the infirmities of age, or the natural inferiority of their mental and bodily powers, were unequal to scenes of hardship and deeds of valour. The youth was not permitted to take arms and join his warlike countrymen in their military expeditions whenever he himself thought proper. There was a certain age before which he could not be invested with armour. When he had attained that period, if not found deficient in strength, activity, or courage, he was formally honoured with the shield and the lance, called to the duties, and admitted to all the privileges, of a warrior.

Another fact worthy of notice respecting the manners of the barbarians of Germany before they established themselves in the cultivated provinces of the Roman empire is, that their women, contrary to what we find among many other rude nations, were treated with an high degree of respect. They did not generally vie with the men in deeds of valour, but they animated them by their exhortations to distinguish themselves in the field; and virgins especially were considered with a sacred veneration, as endowed with prophetic powers, capable to foresee events hid in the womb of futurity, and even to influence the will of the deities. Hence, though domestic duties were their peculiar province, yet they were not harshly treated nor confined to a state of slavery. There appears indeed a striking analogy between the condition of the women among the rude soldiers of Sparta and the rank which they occupied among the warlike cantons of Germany. Perhaps, indeed, the German were still more honourable than the Spartan women; as they were taught to wield the magic weapons of superstition, which in Greece were appropriated to the priests.

8
Respectability of the women among the Germans.

It appears, therefore, that, in the forests of Germany at least, if not in the more northern regions of Asia and Europe, the conquerors of the Roman empire, before they penetrated into its provinces, treated their women with a degree of respect unknown to most of the nations of antiquity; that the character of the warrior was likewise highly honourable, being understood to unite all those qualities which were in the highest estimation; and that it was only at a particular age, and with certain forms, that the youth were admitted to bear arms.

9
Changes in the manners of the barbarians after they settled in the Roman empire, which gave rise to chivalry.

When those nations sallied from their deserts and forests, over-ran the Roman empire, and established themselves in its provinces, the change which took place on their circumstances was remarkable; and by a natural influence, it could not but produce an equally remarkable change on their habits, customs, and manners. The great outlines might still remain; but they could not now fail to be filled up in a different manner. Here, however, the records of history are peculiarly imperfect. We have no Cæsar or Tacitus to supply facts or direct our reasonings; the Gothic nations had not yet learned to read and write; and the Romans were so depressed under the sense of their own miseries, as to be negligent of the changes which happened around them. But as soon as the light of history begins again to dawn, we find that the leading features of the barbarian character were not effaced, but only modified in a particular manner, in consequence of their mixing among a more polished people, becoming acquainted with the luxuries of life, and acquiring extensive power and property.

Those who fought on horseback now began to be distinguished with peculiar honours. The manners of the warrior too were become more cultivated, and his spirit more humane. Leisure and opulence, with the influence of a polished people, even though in a state of slavery, taught those barbarians to aspire after more refined pleasures and more splendid amusements than those which they had been before satisfied with. The influence of christianity too, which, though grossly corrupted, was still favourable to the social happiness of mankind, concurred to polish their manners and exalt their character. Hence, in the end of the tenth and in the beginning of the eleventh century, we see

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knight-errantry, with that romantic gallantry, piety, and humanity, by which it was principally diſtinguiſhed, make its appearance. At the court of every prince, count, or baron, jouſts and tournaments became the favourite amuſements. At thoſe entertainments, ſkill in arms, devotion to the fair, and generous courteſy, were all at once cultivated. About this period began the cruſades; and theſe, to which alone ſome have referred the origin of chivalry, though they could not give riſe to what was already in exiſtence, yet moulded the form and directed the ſpirit of the inſtitution in ſuch a manner, as to raiſe it, by a rapid progreſs from infancy, as it were, to full vigour and maturity. Its character, as it appeared when fully formed, is well deſcribed by an eloquent hiſtorian in the following manner:

*Gibbon*, vol. vi. p. 26.

"Between the age of Charlemagne and that of the cruſades, a revolution had taken place among the Spaniards, the Normans, and the French, which was gradually extended to the reſt of Europe. The ſervice of the infantry was degraded to the plebeians; the cavalry formed the ſtrength of the armies, and the honourable name of *miles*, or ſoldier, was confined to the gentlemen who ſerved on horſeback, and were inveſted with the character of knighthood. The dukes and counts, who had uſurped the rights of ſovereignty, divided the provinces among their faithful barons: the barons diſtributed among their vaſſals the fiefs or benefices of their juriſdiction; and theſe military tenants, the peers of each other and of their lord, compoſed the noble or equeſtrian order, which diſdained to conceive the peaſant or burgher as of the ſame ſpecies with themſelves. The dignity of their birth was preſerved by pure and equal alliances; their ſons alone who could produce four quarters or lines of anceſtry, without ſpot or reproach, might legally pretend to the honour of knighthood; but a valiant plebeian was ſometimes enriched and ennobled by the ſword, and became the father of a new race. A ſingle knight could impart, according to his judgment, the character which he received; and the warlike ſovereigns of Europe derived more glory from this perſonal diſtinction than from the luſtre of their diadem. This ceremony was in its origin ſimple and profane; the candidate, after ſome previous trial, was inveſted with his ſword and ſpurs; and his cheek and ſhoulder were touched with a ſlight blow as the emblem of the laſt affront which it was lawful for him to endure. But ſuperſtition mingled in every public and private action of life: In the holy wars, it ſanctified the profeſſion of arms; and the order of chivalry was aſſimilated in its rights and privileges to the ſacred orders of prieſthood. The bath and white garment of the novice, were an indecent copy of the regeneration of baptiſm: his ſword, which he offered on the altar, was bleſſed by the miniſters of religion; his ſolemn reception was preceded by faſts and vigils; and he was created a knight in the name of God, of St George, and of St Michael the archangel. He ſwore to accompliſh the duties of his profeſſion; and education, example, and the public opinion, were the inviolable guardians of his oath. As the champion of God and the ladies, he devoted himſelf to ſpeak the truth; to maintain the right; to protect the diſtreſſed; to practiſe *courteſy*, a virtue leſs familiar to the ancients; to purſue the infidels; to deſpiſe the allurements of eaſe and ſafety; and to vindicate in every perilous adventure the honour of his character. The abuſe of the ſame ſpirit provoked the illiterate knight to diſdain the arts of induſtry and peace; to eſteem himſelf the ſole judge and avenger of his own injuries; and proudly to neglect the laws of civil ſociety and military diſcipline. Yet the benefits of this inſtitution, to refine the temper of barbarians, and to infuſe ſome principles, of faith, juſtice, and humanity, were ſtrongly felt, and have been often obſerved. The aſperity of national prejudice was ſoftened; and the community of religion and arms ſpread a ſimilar colour and generous emulation over the face of Chriſtendom. Abroad, in enterpriſe and pilgrimage; at home, in martial exerciſe, the warriors of every country were perpetually aſſociated; and impartial taſte muſt prefer a Gothic tournament to the Olympic games of claſſic antiquity. Inſtead of the naked ſpectacles which corrupted the manners of the Greeks, and baniſhed from the ſtadium the virgins and matrons, the pompous decoration of the liſts was crowned with the preſence of chaſte and high-born beauty, from whoſe hands the conqueror received the prize of his dexterity and courage. The ſkill and ſtrength that were exerted in wreſtling and boxing, bear a diſtant and doubtful relation to the merit of a ſoldier; but the tournaments, as they were invented in France, and eagerly adopted both in the eaſt and weſt, preſented a lively image of the buſineſs of the field. The ſingle combats, the general ſkirmiſh, the defence of a paſs or caſtle, were rehearſed as in actual ſervice; and the conteſt, both in real and mimic war, was decided by the ſuperior management of the horſe and lance. The lance was the proper and peculiar weapon of the knight: his horſe was of a large and heavy breed; but his charger, till he was rouſed by the approaching danger, was uſually led by an attendant, and he quietly rode a pad or palfrey of a more eaſy peace. His helmet and ſword, his greaves and buckler, it would be ſuperfluous to deſcribe; but I may remark, that at the period of the cruſades, the armour was leſs ponderous than in latter times; and that, inſtead of a maſſy cuiraſs, his breaſt was defended by an hauberk or coat of mail. When their long lances were fixed in the reſt, the warriors furiouſly ſpurred their horſes againſt the foe; and the light cavalry of the Turks and Arabs could ſeldom ſtand againſt the direct and impetuous weight of their charge. Each knight was attended to the field by his faithful ſquire, a youth of equal birth and ſimilar hopes; he was followed by his archers and men at arms; and four, or five, or ſix ſoldiers, were computed as the furniture of a complete *lance*. In the expeditions to the neighbouring kingdoms or the Holy Land, the duties of the feudal tenure no longer ſubſiſted; the voluntary ſervice of the knights and their followers was either prompted by zeal or attachment, or purchaſed with rewards and promiſes; and the numbers of each ſquadron were meaſured by the power, the wealth, and the fame of each independent chieftain. They were diſtinguiſhed by his banner, his armorial coat, and his cry of war; and the moſt ancient families of Europe muſt ſeek in theſe atchievements the origin and proof of their nobility."

The reſpectable author of the Letters on Chivalry and

and Romance, traces, with great ingenuity and erudition, a ſtrong reſemblance between the manners of the age of chivalry and thoſe of the old heroic ages delineated by Homer.

10
The reſemblance between heroic and Gothic manners.

There is, ſays he, a remarkable correſpondence between the manners of the old heroic times, as painted by their great romancer Homer, and thoſe which are repreſented to us in the modern books of knight-erranty. A fact of which no good account can be given, but by another not leſs certain; that the political ſtates of Greece, in the earlieſt periods of its ſtory, was ſimilar in many reſpects to that of Europe, as broken by the feudal ſyſtem into an infinite number of petty independent governments.

Some obvious circumſtances of agreement between the heroic and Gothic manners may be worth putting down.

1. The military enthuſiaſm of the barons is but of a piece with the fanaticiſm of the heroes. Hence the ſame particularity of deſcription in the accounts of battles, wounds, deaths, in the Greek poet as in the Gothic romancers. Hence that minute curioſity in the diſplay of their dreſſes, arms, accoutrements. The minds of all men being occupied with warlike images and ideas, were much gratified by thoſe details, which appear cold and unaffecting to modern readers.

We hear much of knights-errant encountering giants and quelling ſavages in books of chivalry. Theſe giants were oppreſſive feudal lords; and every lord was to be met with, like the giant, in his ſtrong-hold or caſtle. Their dependents of a lower form, who imitated the violence of their ſuperiors, and had not their caſtles but lurking places, were the ſavages of romance. The greater lord was called a giant for his power; the leſs, a ſavage for his brutality.

2. Another terror of the Gothic ages was monſters, dragons, and ſerpents. Their ſtories were received in thoſe days for ſeveral reaſons: 1. From the vulgar belief of enchantments: 2. From their being reported on the faith of eaſtern tradition, by adventurers from the Holy Land: 3. In ſtill later times from the ſtrange things told and believed on the diſcovery of the new world.

In all theſe reſpects, Greek antiquity reſembles the Gothic. For what are Homer's Læſtrigon's and Cyclops, but bands of lawleſs ſavages, with each of them a giant of enormous ſize at their head? And what are the Grecian Bacchus, Hercules, and Theſeus, but knights-errant, the exact counterparts of Sir Launcelot and Amadis de Gaul?

3. The oppreſſion with which it was the glory of the knights to avenge, were frequently carried on, as we are told, by the *charms and enchantments of women*. Theſe charms, we may ſuppoſe, are often metaphorical; as expreſſing only the blandiſhments of the ſex. Sometimes they are taken to be real, the ignorance of thoſe ages acquieſcing in ſuch conceits. And are not theſe ſtories matched by thoſe of Calypſo and Circe, the enchantreſſes of the Greek poet?

4. Robbery and piracy were honourable in both: ſo far were they from reflecting any diſcredit on the ancient and modern *redreſſers of wrongs*. What account can be given of this, but that, in the feudal times, and in the early days of Greece, when government was weak, and unable to redreſs the injuries of petty ſovereigns, it would be glorious for private adventurers to undertake this work; and, if they could accompliſh it in no other way, to pay them in kind by downright plunder and rapine?



5. Baſtardy was in credit with both. They were extremely watchful over the chaſtity of their own women; but ſuch as they could ſeize upon in the enemies quarter, were lawful prize. Or if, at any time, they tranſgreſſed in this ſort at home, the fault was covered by an ingenious fiction. The offſpring was reputed divine. Their greateſt heroes were the fruit of goddeſſes approached by mortals; juſt as we hear of the doughtieſt knights being born of fairies.

6. With the greateſt fierceneſs and ſavageneſs of character, the utmoſt generoſity, hoſpitality, and courteſy, were imputed to the heroic ages. Achilles was at once the moſt relentleſs, vindictive, implacable, and the friendlieſt of men. We have the very ſame repreſentation in the Gothic romances. As in thoſe lawleſs times, dangers and diſtreſſes of all kinds abounded, there would be the ſame demand for compaſſion, gentleneſs, and generous attachment to the unfortunate, thoſe eſpecially of their own clan, as of reſentment, rage, and animoſity againſt their enemies.

7. Again, the martial games celebrated in ancient Greece, on great and ſolemn occaſions, had the ſame origin and the ſame purpoſe as the tournaments of the Gothic warriors.

8. Laſtly, the paſſions for adventures ſo natural in their ſituation, would be as naturally attended with the love of praiſe and glory. Hence the ſame encouragement, in the old Greek and Gothic times, to panegyriſts and poets. In the affairs of religion and gallantry, indeed, the reſemblance between the hero and the knight is not ſo ſtriking. But the religious character of the knight was an accident of the times and no proper effect of his civil condition. And that his devotion for the fair ſex ſhould ſo far ſurpaſs that of the hero, is a confirmation of the ſyſtem here advanced. For the conſideration had of the females in the feudal conſtitution, will of itſelf account for this deference. It made them capable of ſucceeding to fiefs, as well as the men. And does not one ſee, on the inſtant, what reſpect and dependence this privilege would draw upon them?

It was of mighty conſequence who ſhould obtain the favour of a rich heireſs. And though, in the ſtrict feudal times, ſhe was ſuppoſed to be in the power and at the diſpoſal of her ſuperior lord, yet this rigid ſtate of things did not laſt long. Hence we find ſome diſtreſſed damſel was the ſpring and mover of every knight's adventure. She was to be reſcued by his arms, or won by the fame and admiration of his prowеſs. The plain meaning of all which was this: That as, in theſe turbulent times, a protector was neceſſary to the weakneſs of the ſex, ſo the courteous and valorous knight was to approve himſelf qualified for that purpoſe.

It may be obſerved, that the two poems of Homer were intended to expoſe the miſchiefs and inconveniences ariſing from the political ſtate of Old Greece: the *Iliad*, the diſſentions that naturally ſpring up among independent chiefs; and the *Odyſſey* the inſolence of their greater ſubjects, more eſpecially when unreſtrained by the preſence of their ſovereign. And can any thing more exactly reſemble the condition of

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Chivalry. the feudal times, when, on occasion of any great enterprise, as that of the crusades, the designs of the confederate Christian states were perpetually frustrated, or interrupted at least, by the dissentions of their leaders; and their affairs at home, as perpetually distressed and disordered by the rebellious usurpations of their greater vassals? Jerusalem was to the European what Troy had been to the Grecian princes. See the article KNIGHT.

CHIVALRY, in law, is used for a tenure of lands by knight's service; whereby the knight was bound to perform service in war unto the king, or the mesne lord of whom he held by that tenure. And chivalry was either general or special: *general*, when it was only in the feoffment that the tenant held *per servitium militare*, without any specification of sergeantry, escuage; &c.; *special*, when it was declared particularly by what kind of knight service the land was held.

For the better understanding of this tenure it hath been observed, that there is no land but is holden mediately or immediately of the crown by some service; and therefore all freeholds that are to us and our heirs, are called *feuda* or *feoda*, "fees;" as proceeding from the king for some small yearly rent, and the performance of such services as were originally laid upon the land at the donation thereof. For as the king gave to the great nobles his immediate tenants, large possessions for ever, to hold of him for this or that service or rent; so they in time parcelled out to such others as they liked the same lands for rents and services as they thought good: and these services were by Littleton divided into two kinds, *chivalry* and *socage;* the first whereof was martial and military, the other rustical. Chivalry, therefore, was a tenure of service, whereby the tenant was obliged to perform some noble or military office unto his lord: and it was of two kinds, either *regal*, that is, held only by the king; or *common*, where held of a common person. That which might be held only of the king was called *servitium*, or *sergeantia;* and was again divided into *grand* and *petit* serjeanty. The grand serjeanty was where one held lands of the king by service, which he ought to do in his own person; as to bear the king's banner or spear, to lead his host, to find men at arms to fight, &c. Petit serjeanty was when a man held lands of the king, to yield him annually some small thing towards his wars, as a sword, dagger, bow, &c. Chivalry that might be holden of a common person was termed *scutagium*, "escuage;" that is, service of the shield; which was either uncertain or certain.

*Escuage uncertain*, was likewise two-fold: first, where the tenant was bound to follow his lord, going in person to the king's wars, either himself, or sending a sufficient man in his place, there to be maintained at his expence, so long as was agreed upon between the lord and his first tenant at the granting of the fee; and the days of such service seem to have been rated by the quantity of land so holden: as if it extended to a whole knight's fee, then the tenant was to follow his lord 40 days; and if but to half a knight's fee, then 20 days; if a fourth part, then 10 days, &c. The other kind of this escuage was called *castle-ward*, where the tenant was obliged, by himself or some other, to defend a castle as often as it should come to his turn. And these were called *escuage uncertain;* because it was uncertain how often a man should be called to follow his lord to the wars, or to defend a castle, and what his charge would be therein. Chivalry.

*Escuage certain*, was where the tenure was set at a certain sum of money to be paid in lieu of such service; as that a man should pay yearly for every knight's fee 20s. for half a knight's fee 10s. or some like rate; and this service, because it is drawn to a certain rent, groweth to be of a mixed nature, not merely socage, and yet socage in effect, being now neither personal service nor uncertain. The tenure called chivalry had other conditions annexed to it: but there is a great alteration made in these things by the stat. 12. Car. 2. c. 24. whereby tenures by knight's service of the king, or any other person *in capite*, &c. and the fruits and consequences thereof, are taken away and discharged; and all tenures are to be construed and adjudged to be free and common socage, &c.

*Court of* CHIVALRY, a court formerly held before the lord high constable and earl marshal of England jointly, and having both civil and criminal jurisdiction: but since the attainder of Stafford Duke of Buckingham under Henry VIII. and the consequent extinguishment of the office of lord high constable, it hath usually, with respect to civil matters, been heard before the earl marshal only. This court, by stat. 13. Rich. II. c. 2. hath cognizance of contracts and other matters touching deeds of arms and war, as well out of the realm as in it. And from its sentences lies an immediate appeal to the king in person. This court was in great reputation in the times of pure chivalry; and afterwards during the English connections with the continent, by the territories which their princes held in France: but it is now grown almost entirely out of use, on account of the feebleness of its jurisdiction, and want of power to enforce its judgments; as it can neither fine nor imprison, not being a court of record.

1. The *civil* jurisdiction of this court of chivalry is principally in two points; the redressing injuries of honour, and correcting encroachments in matters of coat armour, precedency, and other distinctions, of families. As a court of honour, it is to give satisfaction to all such as are aggrieved in that point; a point of a nature so nice and delicate, that its wrongs and injuries escape the notice of the common law, and yet are fit to be redressed somewhere. Such, for instance, as calling a man a *coward*, or giving him the lie; for which, as they are productive of no immediate damage to his person or property, no action will lie in the courts at Westminster: and yet they are such injuries as will prompt every man of spirit to demand some honourable amends; which by the ancient law of the land, was given in the court of chivalry. But modern resolutions have determined, that how much soever a jurisdiction may be expedient, yet no action for words will at present lie therein. And it hath always been most clearly holden, that as this court cannot meddle with any thing determinable by common law, it therefore can give no pecuniary satisfaction or damages; in as much as the quantity and determination thereof is ever of common law cognizance. And therefore this court of chivalry can at most order reparation in point of honour; as, to compel

compel the defendant *mendacium sibi ipsi imponere*, or to take the lie that he has given upon himself, or to make such other submission as the laws of honour may require. As to the other point of its civil jurisdiction, the redressing of usurpations and encroachments in matters of heraldry and coat-armour; it is the business of this court, according to Sir Matthew Hale, to adjust the rights and armorial ensigns, bearings, crests, supporters, pennons, &c.; and also rights of places, precedence, where the king's patent or act of parliament, which cannot be over-ruled, by this court, have not already determined it. The proceedings of this court are by petition in a summary way: and the trial not by a jury of twelve men, but by witnesses, or by combat. But as it cannot imprison, not being a court of record; and as, by the resolutions of the superior courts, it is now confined to so narrow and restrained a jurisdiction; it has fallen into contempt. The marshalling of coat-armour, which was formerly the pride and study of all the best families in the kingdom, is now greatly disregarded; and has fallen into the hands of certain officers and attendants upon this court, called *heralds*, who consider it only as a matter of lucre, and not of justice: whereby such falsity and confusion have crept into their records (which ought to be the standing evidence of families, descents, and coat armour), that though formerly some credit has been paid to their testimony, now, even their common seal will not be received as evidence in any court of justice in the kingdom. But their original visitation books, compiled when progresses were solemnly and regularly made into every part of the kingdom, to inquire into the state of families, and to register such marriages and descents as were verified to them upon oath, are allowed to be good evidence of pedigrees.

2. As a *criminal* court, when held before the lord high constable of England jointly with the earl marshal, it had jurisdiction over pleas of life and member, arising in matters of arms and deeds of war, as well out of the realm as within it. But the criminal as well as civil part of its authority is fallen into entire disuse: there having been no permanent high constable of England (but only *pro hac vice*, at coronations and the like), since the attainder and execution of Stafford Duke of Buckingham, in the 13th year of Henry VIII.; the authority and charge, both in war and peace being deemed too ample for a subject; so ample, that when the chief justice Fineux was asked by King Henry VIII. how far they extended? he declined answering; and said, the decision of that question belonged to the law of arms, and not to the law of England.

CHIVES, in botany, are slender thread-like substances, generally placed within the blossom, and surrounding the POINTALS. They are formed of the woody substance of the plant.

CHIUM MARMOR, in the natural history of the ancients, the name of a black marble, called also the *lapis opsidianus*. It is very hard, and of a fine black; and, beside the many uses which the ancients put it to, is well known among our goldsmiths by the name of the *touchstone*; most of them being furnished with nothing better for this purpose than a piece of this: though the basaltes, which might be had plentifully enough, is greatly preferable for those uses; any black marble, however, that is tolerably hard, will do. There is a very fine and elegantly smooth marble, of a compact texture, and fine glossy black, but showing no glittering particles when fresh broken, as most of the black marbles do. It is extremely hard, and cuts with difficulty, but is capable of the highest polish of any marble. The ancients had it from Ethiopia and the island of Chios; we have it from Italy.



*CHIUM Vinum, Chian Wine*, or wine of the growth of the island of Chios, now Scio, is commended by Dioscorides as affording good nourishment, fit to drink, less disposed to intoxicate, endued with the virtue of restraining defluxions, and a proper ingredient in ophthalmic medicines. Hence Scribonius Largus directs the dry ingredients in collyria for the eyes to be made up with Chian wine.

CHIUN, or CHEVAN, in Hebrew antiquity. We meet with this word in the prophet Amos, cited in the Acts of the Apostles. St Luke reads the passage thus: "Ye took up the tabernacle of Moloch, and the star of your god Remphan, figures which ye made to worship them." The import of the Hebrew is as follows: "Ye have borne the tabernacle of your kings, and the pedestal (the *chiun)* of your images, the star of your gods, which ye made to yourselves." The Septuagint in all probability read *Repham* or *Revan*, instead of *Chiun* or *Chevan*, and took the pedestal for a god.

Some say that the Septuagint, who made their translation in Egypt, changed the word *Chiun* into that of *Remphan* because they had the same signification. M. Basnage, in his book intitled *Jewish Antiquities*, after having discoursed a good deal upon *Chion* or *Remphan*, concludes that Moloch was the sun, and *Chion, Chiun*, or *Remphan*, the moon.

CHLAMYS, in antiquity, a military habit worn by the ancients over the tunica. It belonged to the patricians, and was the same in the time of war that the toga was in the time of peace. This sort of gown was called *picta*, from the rich embroidery with figures in Phrygian work; and *purpurea*, because the groundwork was purple. The chlamydes of the emperors were all purple, adorned with a golden and embroidered border.

CHLOEIA, in antiquity, a festival celebrated at Athens in honour of Ceres, to whom, under the name Χλοη, *i. e. Grass*, they sacrificed a ram.

CHLORA, in botany, a genus of the monogynia order, belonging to the octandria class of plants. The calyx is octophyllous, the corolla monopetalous and octofid; the capsule unilocular, bivalved, and polyspermous.

CHLOROSIS, in medicine, a disease, commonly called the *green-sickness*, incident to young girls. See (the Index subjoined to) MEDICINE.

CHOCOLATE, in commerce, a kind of paste or cake prepared of certain ingredients, the basis of which is cacao. See CACAO.

The Indians, in their first making of chocolate, used to roast the cacao in earthen pots; and having afterwards cleared it of the husks, and bruised it between two stones, they made it into cakes with their hands. The Spaniards improved this method: when the cacao is properly roasted and well cleaned, they pound it in a a mortar, to reduce it into a coarſe maſs, which they afterwards grind on a ſtone till it be of the utmoſt fineneſs: the paſte being ſufficiently ground, is put quite hot into tin moulds, in which it congeals in a very little time. The form of theſe moulds is arbitrary: the cylindrical ones, holding two or three pounds, are the moſt proper; becauſe the bigger the cakes are, the longer they will keep. Obſerve, that theſe cakes are very liable to take any good or bad ſcent, and therefore they muſt be carefully wrapt up in paper, and kept in a dry place. Complaints are made, that the Spaniards mix with the cacao nuts too great a quantity of cloves and cinnamon, beſides other drugs without number, as muſk, ambergreaſe, &c. The grocers of Paris uſe few or none of theſe ingredients: they only chooſe the beſt nuts, which are called *caracca*, from the place from whence they are brought; and with theſe they mix a very ſmall quantity of cinnamon, the freſheſt vanilla, and the fineſt ſugar, but very ſeldom any cloves. In England, the chocolate is made of the ſimple cacao, excepting that ſometimes ſugar and ſometimes vanilla is added.

Chocolate ready made, and cacao paſte, are prohibited to be imported into Britain from beyond the ſeas. If made and ſold in Great Britain, it pays inland duty 1s. 6d. *per lb.* avoirdupoiſe: it muſt be incloſed in papers containing one pound each, and produced at the exciſe-office to be ſtamped. Upon three days notice given to the officer of exciſe, private families may make chocolate for their own uſe, provided no leſs than half an hundred weight of nuts be made at one time.

The chocolate made in Portugal and Spain is not near ſo well prepared as the Engliſh, depending perhaps on the machine employed there, *viz.* the double cylinder, which ſeems very well calculated for exact triture. If perfectly prepared, no oil appears on the ſolution. London chocolate gives up no oil like the foreign; and it alſo may, in ſome meaſure, depend on the thickneſs of the preparation. The ſolution requires more care than is commonly imagined. It is proper to break it down, and diſſolve it thoroughly in cold water by milling it with the chocolate ſtick. If heat is applied, it ſhould be done ſlowly: for, if ſuddenly, the heat will not only coagulate it, but ſeparate the oil; and therefore much boiling after it is diſſolved, is hurtful. Chocolate is commonly required by people of weak ſtomachs; but often rejected for want of proper preparation. When properly prepared, it is eaſily diſſolved; and an excellent food where a liquid nutrient vegetable one is required, and is leſs flatulent than any of the farinacea.

Mr Henly, an ingenious electrician, has lately diſcovered that chocolate, freſh from the mill, as it cools in the tin-pans into which it is received, becomes ſtrongly electrical; and that it retains this property for ſome time after it has been turned out of the pans, but ſoon loſes it by handling. The power may be once or twice renewed by melting it again in an iron ladle, and pouring it into the tin pans as at firſt; but when it becomes dry and powdery, the power is not capable of being revived by ſimple melting: but if a ſmall quantity of olive oil be added, and well mixed with the chocolate in the ladle, its electricity will be completely reſtored by cooling it in the tin-pan as before. From this experiment he conjectures, that there is a great affinity between phlogiſton and the electric fluid, if indeed they be not the ſame thing.



*Chocolate-Nut Tree.* See Cacao.

CHOENIX, χοινιξ, an ancient dry meaſure, containing the 48th part of a *medimnus*, or ſix buſhels.

CHOERILUS, a tragic poet of Athens about the 64th Olympiad. He wrote 150 tragedies, of which 13 had obtained the prize.—An hiſtorian of Samos.—Two other poets, one of whom was very intimate with Herodotus. He wrote a poem on the victory which the Athenians had obtained over Xerxes; and on account of the excellence of the compoſition he received a piece of gold for each verſe from the Athenians. The other was one of Alexander's flatterers and friends.

CHOERINÆ, in antiquity, a kind of ſea-ſhells, with which the ancient Greeks uſed to give their ſuffrage or vote.

CHOIR, that part of the church or cathedral where choiriſters ſing divine ſervice; it is ſeparated from the chancel where the communion is celebrated, and alſo from the nave of the church where the people are placed: the patron is ſaid to be obliged to repair to the choir of the church. It was in the time of Conſtantine that the choir was ſeparated from the nave. In the twelfth century they began to incloſe it with walls; but the ancient baluſtrades have ſince been reſtored, out of a view to the beauty of architecture.

Choir in nunneries, is a large hall adjoining to the body of the church, ſeparated by a grate, where the nuns ſing the office.

CHOISI (Francis Timoleon de), dean of the cathedral of Bayeux, and one of the forty of the French academy, was born at Paris in 1644. In 1685, he was ſent with the chevalier de Chamont to the king of Siam, and was ordained prieſt in the Indies by the apoſtolical vicar. He wrote a great number of works, in a polite, florid, and eaſy ſtile; the principal of which are, 1. Four dialogues on the Immortality of the Soul, *&c.* 2. Account of a voyage to Siam. 3. An Eccleſiaſtical Hiſtory, in 11 vols. 4to. 4. Life of David, with an interpretation of the Pſalms. 5. Life of Solomon, *&c.* he died at Paris, in 1724.

CHOLEDOCHUS, in anatomy, a term applied to a canal or duct, called alſo *ductus communis;* formed of the union of the porus bilarius and ductus cyſticus. The word comes from χολη, *choler;* and δεχομαι, *I receive*, or *contain*.

The choledochus ductus paſſing obliquely to the lower-end of the duodenum, ſerves to convey the bile from the liver to the inteſtines. See Anat. nº 97.

CHOLER. See Bile.

CHOLERA morbus, a ſudden eruption or overflowing of the bile or bilious matters both upwards and downwards. See (the *Index* ſubjoined to) Medicine.

CHOMER, or Omer. See Corus.

CHONDRILLA, in botany, a genus of the polygamia equalis order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ*. The receptacle is naked; the calyx calyculated; the pappus ſimple and ſtalked; the florets in a manifold ſeries.

CHONDROPTERYGII, in ichthyology, a term for-

formerly applied to the order of fishes now called *amphibia nantes* by Linnæus. See AMPHIBIA.

CHOP-CHURCH, or CHURCH-CHOPPER, a name, or rather nick-name, given to parsons who make a practice of exchanging benefices. See PERMUTATION.

*Chop-church* occurs in an ancient statute as a lawful trade or occupation; and some of the judges say it was a good addition. Brook holds that it was no occupation, but a thing permissible by law.

CHOPIN, or CHOPINE, a liquid measure used both in Scotland and France, and equal to half their pint. See PINT and MEASURE.

CHOPIN (Rene), a famous civilian born at Bailleul in Anjou in 1537. He was advocate in the parliament of Paris, where he pleaded for a long time with great reputation. He at last shut himself up in his closet; and composed many works, which have been collected together, and printed in 6 vols, folio. He died at Paris in 1606.

CHORAL, signifies any person that, by virtue of any of the orders of the clergy, was in ancient times admitted to sit and serve God in the choir.

Dugdale, in his history of St Paul's Church, says, that there were with the chorus formerly six vicars choral belonging to that church.

CHORASSAN, or KHORASSAN, a province of Persia adjoining to Usbec Tartary. This was the ancient Bactria, and the birth-place of Kouli Khan.

CHORAX, or CHARAX. See CHARACENE.

CHORAZIM, or CHORAZIN, (Luke, Mathew), a town of Galilee: whose wretched incredulity Christ deplores: now desolate, at two miles distance from Capernaum.

CHORD, or CORD, primarily denotes a slender rope or cordage *. The word is formed of the Latin, *chorda*, and that from the Greek, χορδη, *a gut*, whereof strings may be made.

* See *Cordage*.

CHORD, in geometry, a right line drawn from one part of an arch of a circle to another. Hence,

*CHORD of an Arch*, is a right line joining the extremities of that arch.

CHORD, in music, the union of two or more sounds uttered at the same time, and forming together an entire harmony.

The natural harmony produced by the resonance of a sounding body, is composed of three different sounds, without reckoning their octaves; which form among themselves the most agreeable and perfect chord that can possibly be heard: for which reason they are called, on account of their excellence, *perfect chords*. Hence, in order to render this harmony complete, it is necessary that each cord should at least consist of three sounds. The trio is likewise found by musicians to include the perfection of harmony; whether because in this all the cords, and each in its full perfection, are used; or, because upon such occasions as render it improper to use them all, and each in its integrity, arts have been successfully practised to deceive the ear, and to give it contrary persuasion, by deluding it with the principal sounds of each *chord*, in such a manner as to render it forgetful of the other sounds necessary to their completion. Yet the octave of the principal sound produces new relations, and new consonances, by the completion of the intervals: they commonly add this octave, to have the assemblage of all the consonances in one and the same *chord*; (See CONSONANCE.) Moreover, the addition of the dissonance (see DISCORD), producing a fourth sound superadded to the perfect chord, it becomes indispensibly necessary, if we would render the cord full, that we should include a fourth part to express this dissonance. Thus the series of chords can neither be complete nor connected but by means of four parts.

*Chords* are divided into perfect and imperfect. The *perfect chord* is that which we have lately described; which is composed of the fundamental sound below, of its third, is fifth, and its octave: they are likewise subdivided into major and minor, according as the thirds which enter into their composition are flat or sharp: (See INTERVAL.) Some authors likewise give the name of *perfect* to all chords, even to dissonances, whose fundamental sounds are below. Imperfect *chords* are those in which the sixth, instead of the fifth, prevails, and in general all those whose lowest are not their fundamental sounds. These denominations, which had been given before the fundamental bass was known, are now most unhappily applied: those of chords *direct* and *reversed*, are much more suitable in the same sense.

*Chords* are once more divided into consonances and dissonances. The chords denominated *consonances*, are the perfect chord, and its derivatives: every other chord is a *dissonance*.

A table of both, according to the system of M. Rameau, may be seen in Rousseau's Musical Dictionary, vol. I. p. 27.

After the table to which our readers have been remitted, Rousseau adds the following observations, which are at the same time so just and so important, that we should be very sorry if they escape the reader's attention.

At the words *harmony*, *fundamental bass*, *composition*, &c. he promises to treat concerning the manner of using all the chords to form regular harmony; and only adds, in this place, the subsequent reflections.

1. It is a capital error to imagine, that the methods of inverting the same chord are in all cases equally eligible for the harmony and for the expression. There is not one of these different arrangements but had its proper character. Every one feels the contrast between the softness of the false fifth, and the grating sound of the tritone, though the one of these intervals is produced by a method of inverting the other. With the seventh diminished, and the second redundant, the case is the same with the interval of the second in general use, and the seventh. Who does not feel how much more vocal and sonorous the fifth appears when compared with the fourth? The *chord* of the great sixth, and that of the lesser sixth minor, are two forms of the same fundamental *chord*: but how much less is the one harmonious than the other? On the contrary, the *chord* of the lesser sixth major is much more pleasing and cheerful than that of the false fifth. And only to mention the most simple of all *chords*, reflect on the majesty of the perfect chord, the sweetness of that which is called the chord of the sixth, and the insipidity of that which is composed of a sixth

a ſixth and a fourth; all of them, however, compoſed of the ſame ſounds. In general, the redundant intervals, the ſharps in the higher part, are proper by their ſeverity to expreſs violent emotions of mind, ſuch as anger and the rougher paſſions. On the contrary, flats in the higher parts, and diminiſhed intervals, form a plaintive harmony, which melts the heart. There are a multitude of ſimilar obſervations, of which when a muſician knows how to avail himſelf, he may command at will the affections of thoſe who hear him.

2. The choice of ſimple intervals is ſcarcely of leſs importance than that of the *chords*, with regard to the ſtations in which they ought to be placed. It is, for inſtance, in the lower parts that the fifth and octave ſhould be uſed in preference; in the upper parts, the third and ſixth are more proper. If you tranſpoſe this order, the harmony will be ruined even tho' the ſame *chords* are preſerved.

3. In a word, the *chords* are rendered ſtill more harmonious, by being approximated and only divided by the ſmalleſt practicable intervals, which are more ſuitable to the capacity of the ear than ſuch as are remote. This is what we call *contracting* the harmony, an art which few compoſers have ſkill and abilities enough to put in practice. The limits in the natural compaſs of voices, afford an additional reaſon for leſſening the diſtance of the intervals, which compoſe the harmony of the chorus, as much as poſſible. We may affirm, that a chorus, is improperly compoſed, when the diſtance between the *chords* increaſes; when thoſe who perform the different parts are obliged to ſcream; when the voices riſe above their natural extent, and are ſo remotely diſtant one from the other that the perception of harmonical relations between them is loſt.

We ſay likewiſe, that an inſtrument is in *concord* when the intervals between its fixed ſounds are what they ought to be; we ſay in this ſenſe, that the *chords* of an inſtrument are true or falſe, that it preſerves or does not preſerve its *chords*. The ſame form of ſpeaking is uſed for two voices which ſing together, or for two ſounds which are heard at the ſame time, whether in uniſon or in parts.

Chords, or *Cords, of Muſical inſtruments*, are ſtrings, by the vibration of which the ſenſation of ſound is excited, and by the diviſions of which the ſeveral degrees of tone are determined.

CHORDEE, in medicine and ſurgery, a ſymptom attending a gonorrhœa, conſiſting in a violent pain under the frenum, and along the duct of the urethra during the erection of the penis, which is incurvated downwards. Theſe erections are frequent and involuntary.

CHOREA Sancti Viti. See *Vitus's-Dance*.

CHOREPISCOPUS, an officer in the ancient church, about whoſe function the learned are extremely divided, The word comes from χωρος, a *region, little country*, and επισκοπος, *a biſhop*, or *overſeer*.

The chorepiſcopi were ſuffragan or local biſhops, holding a middle rank between biſhops and preſbyters, and delegated to exerciſe epiſcopal juriſdiction within certain diſtricts, when the boundaries of particular churches, over with ſeparate biſhops preſided, were conſiderably enlarged. It is not certain when this office was firſt introduced: ſome trace it to the cloſe of the firſt century; others tell us, that chorepiſcopi were not known in the eaſt till the beginning of the fourth century: and in the weſt about the year 439. They ceaſed both in the eaſt and weſt in the tenth century.

Chorepiscopus is alſo the name of a dignity ſtill ſubſiſting in ſome cathedrals, particularly in Germany; ſignifying the ſame with *chori epiſcopus*, or "biſhop of the choir." The word, in this ſenſe, does not come from χωρος, *place*, but χορος, *quoir*, &c. In the church of Cologne, &c. the firſt chanter is called *chorepiſcopus*.

CHOREUS, Χορειος, a foot in the ancient poetry, more commonly called *trochæus*. See Trochee.

CHORIAMBUS, in ancient poetry, a foot conſiſting of four ſyllables, whereof the firſt and laſt are long, and the two middle ones are ſhort; or, which is the ſame thing, it is made up of a trochæus and iambus; ſuch is the word *nobilitas*.

CHORION, in anatomy, the exterior membrane which inveſts the foetus in the uterus. See Foetus.

CHOROBATA, or Chorobates, a kind of water level among the ancients, of the figure of the letter T, according to Vitruvius's deſcription.

CHOROGRAPHY, the art of making a map of ſome country or province.

Chorography differs from geography, as the deſcription of a particular country is different from that of the whole earth; and from topography, as the deſcription of a country is different from that of a town or diſtrict. See the articles Geography, Topography, and Map.

CHOROIDES, or Choroeides, in anatomy, a term applied to ſeveral parts of the body; bearing ſome reſemblance to the chorion. The word is formed from χοριον, *chorion*, and ειδος, *likeneſs*.

Choroides is particularly uſed for the inner membrane which immediately inveſts the brain; ſo called as being intermingled with a great number of bloodveſſels, like the *chorion*: but more uſually denominated the *pia mater*, or *meninx tenuis*.

*Plexus* or *Lacis Choroides*, is a knot of veins and arteries in the anterior ventricle of the brain, woven out of the branches of the carotid.

Choroides is alſo applied to the inner and poſterior tunic of the eye, immediately under the ſclerotica. It is ſoft, thin, and black; and its inner or concave ſurface is very ſmooth and poliſhed. It has its name from its being interſperſed with veſſels.

CHORUS, in dramatic poetry, one or more perſons preſent on the ſtage during the repreſentation, and ſuppoſed to be by-ſtanders without any ſhare in the action.

Tragedy in its origin was no more than a ſingle chorus, who trod the ſtage alone, and without any actors, ſinging dithyrambics or hymns in honour of Bacchus. Theſpis, to relieve the chorus, added an actor, who rehearſed the adventures of ſome of their heroes; and Æſchylus, finding a ſingle perſon too dry an entertainment, added a ſecond, at the ſame time reducing the ſinging of the chorus, to make more room for the recitation. But when once tragedy began to be formed, the recitative, which at firft was intended only as an acceffory part to give the chorus a breathing time, became a principal part of the tragedy. At length, however, the chorus became inferted and incorporated into the action: fometimes it was to fpeak; and then their chief, whom they called *coryphæus*, fpoke in behalf of the reft: the finging was performed by the whole company; fo that when the coryphæus ftruck into a fong, the chorus immediately joined him.

The chorus fometimes alfo joined the actors in the courfe of the reprefentation, with their plaints and lamentations on account of any unhappy accidents that befel them: but the proper function, and that for which it feemed chiefly retained, was to fhow the intervals of the acts: while the actors were behind the fcenes, the chorus engaged the fpectators; their fongs ufually turned on what was exhibited, and were not to contain any thing but what was fuited to the fubject, and had a natural connection with it; fo that the chorus concurred with the actors for advancing the action. In the modern tragedies the chorus is laid afide, and the fiddles fupply its place M. Dacier looks on this retrenchment as of ill confequence, and thinks it robs tragedy of a great part of its luftre; he therefore judges it neceffary to re-eftablifh it, not only on account of the regularity of the piece, but alfo to correct, by prudent and virtuous reflections, any extravagances that might fall from the mouths of the actors when under any violent paffion.

M. Dacier obferved alfo, that there was a chorus, or grex, in the ancient comedy: but this is fuppreffed in the new comedy, becaufe it was ufed to reprove vices by attacking particular perfons; as the chorus of the tragedy was laid afide to give the greater probability to thofe kinds of intrigue which require fecrecy.

Chorus, in mufic, is when, at certain periods of a fong, the whole company are to join the finger in repeating certain couplets or verfes.

CHOSE, *(Fr.)* "a thing;" ufed in the common law with divers epithets; as *chofe local*, *chofe tranfitory*, and *chofe in action*. Chofe local is fuch a thing as is annexed to a place, as a mill and the like; chofe tranfitory, is that thing which is moveable, and may be taken away, or carried from place to place; and chofe in action is a thing incorporeal, and only a *right*, as an obligation for debt, annuity, &c. And generally all caufes of fuit for any debt, duty, or wrong, are to be accounted chofes in action: and it feems, chofe in action may be alfo called *chofe in fufpence;* becaufe it hath no real exiftence, or being, nor can properly be faid to be in our poffeffion.

CHOSROES I. the Great, king of Perfia, after his father Cabades, A. D. 532. He made peace with the Romans; but broke it the third year, and forced Juftinian to a difadvantageous peace. Afterward, he was fo fwelled with his victories, as to bid the emperor's ambaffador follow him for audience to Cæfarea: but Tiberius fent an army under Juftinian; who made himfelf mafter of the country, and put Chofroes to death in 586.

Chosroes II. His fubjects put his father Hormifdas in prifon, and the fon upon the throne of Perfia. He ufed his father tenderly at firft; but afterwards caufed him to be put to death. This, together with his killing fome of the nobility, obliged him to fly: he gave his horfe the bridle, which carried him into a town of the Romans, where Mauricius the emperor received him kindly, and fent an army under Narfes, which fet him again upon the throne. He took Jerufalem; after this he made himfelf mafter of Libya and Egypt, and carried Carthage. Heraclius fued for peace; which was offered him on condition, *That he and his fubjects fhould deny Jefus Chrift:* Hereupon Heraclius attacked him with fuccefs, and put him to flight. His own fon purfued him, and he was ftarved in prifon in 627.



CHOUCH, in ornithology, the trivial name of a fpecies of Corvus.

CHOUS, in the eaftern military orders, the title of the meffengers of the divan of Janifaries. There are feveral degrees of honour in this poft. When a perfon is firft advanced to it, he is called a *cuchuk*, or little *chous*; after this he is advanced to be the *alloy chous;* that is, the meffenger of ceremonies; and from this, having paffed through the office of *petelma*, or procurator of the effects of the body, he is advanced to be the *bas chous*.

CHOWDER-beer, a provincial phrafe of Devonfhire, in England, denoting a cheap and eafily prepared drink, highly commended for preventing the fcurvy in long voyages, or for the cure of it where it may have been contracted. It is prepared in the following manner: Take twelve gallons of water, in which put three pounds and a half of black fpruce: boil it for three hours, and having taken out the fir or fpruce, mix with the liquor feven pounds of melaffes, and juft boil it up; ftrain it through a fieve, and when milk warm put to it about four fpoonfuls of yeft to work it. In two or three days ftop the bung of the cafk; and in five or fix days, when fine, bottle it for drinking. Two gallons of melaffes are fufficient for an hogfhead of liquor; but if melaffes cannot be procurod, treacle or coarfe fugar will anfwer the purpofe.

CHREMNITZ, the principal of the nine-towns in Upper Hungary, fituated about 68 miles north-eaft of Prefburg, and fubject to the houfe of Auftria. E. Long. 19. N. Lat. 48. 45.

CHRENECRUDA, a term occurring in writers of the middle age, and expreffing a cuftom of thofe times; but its fignification is doubtful. It is mentioned in *Lege Salica*, Tit. 61. which fays, he who kills a man, and hath not wherewithal to fatisfy the law or pay the fine, makes oath that he has delivered up every thing he was poffeffed of; the truth of which muft be confirmed by the oaths of 12 other perfons. Then he invites his next relations by the father's fide to pay off the remainder of the fine, having firft made over to them all his effects by the following ceremony. He goes into his houfe, and taking in his hand a fmall quantity of duft from each of the four corners, he returns to the door, and with his face inwards throws the duft with his left hand over his fhoulders upon his neareft of kin. Which done, he ftrips to his fhirt; and coming out with a pole in his hand, jumps over the hedge. His relations, whether one or feveral, are upon

upon this obliged to pay off the composition for the murder. And if these (or any one of them) are not able to pay, *iterum super illum chrenecruda, qui pauperior est, jactat, et ille totam legem componat.* Whence it appears, that *chrenecruda jactare,* is the same with throwing the dust, gathered from the four corners of the house. Goldastus and Spelman translate it *viridem herbam,* "green grass," from the German *gruen kraut,* or from the Dutch *groen,* "green," and *gruid,* "grass." Wendelinus is of a contrary opinion, who thinks that by this word *denotari purificationis approbationem,* from *chrein,* "pure, chaste, clean;" and *keuren,* "to prove;" so that it must refer to the oaths of the twelve jurors. Be this as it will, king Childebert reformed this law by a decree, chap. 15. both because it favoured of pagan ceremonics, and because several persons were thereby obliged to make over all their effects: *De chrenecruda lex quam paganorum tempore observabant, deinceps nunquam valeat, quia per ipsam cecidit multorum potestas.*

CHRISM (from χριω, *I anoint),* oil consecrated by the bishop, and used in the Romish and Greek churches, in the administration of baptism, confirmation, ordination, and extreme unction, which is prepared on holy Thursday with much ceremony. In Spain it was anciently the custom for the bishop to take one third of a sol for the chrism distributed to each church, on account of the balsam that entered its composition.

Du Cange observes, that there are two kinds of chrism; the one prepared of oil and balsam, used in baptism, confirmation, and ordination; the other of oil alone, consecrated by the bishop, used anciently for the catechumens, and still in extreme unction. The Maronites, before their reconciliation with Rome, besides oil and balsam, used musk, saffron, cinnamon, roses, white frankincense, and several other drugs mentioned by Rynaldus, in 1541, with the doses of each. The Jesuit Dandini, who went to mount Libanus in quality of the pope's nuncio, ordained, in a synod held there in 1596, that chrism for the future should be made only of two ingredients, oil and balsam; the one representing the human nature of Jesus Christ, the other his divine nature. The action of imposing the chrism is called *chrismation:* this the generality of the Romish divines hold to be the next matter of the sacrament of confirmation.

The chrismation in baptism is performed by the priest; that in confirmation by the bishop; that in ordination, &c. is more usually styled *unction.*

*Chrism Pence, Chrismatis Denarii,* or *Chrismales Denarii,* a tribute anciently paid to the bishop by the parish-clergy, for their chrism, consecrated at Easter for the ensuing year: this was afterwards condemned as simoniacal.

CHRISOM, Chrismale, was anciently the face-cloth or piece of linen laid over the child's head when it was baptized. Whence, in the bills of mortality, children who die in the mouth are called *chrisoms.* The time between the child's birth and baptism was also called *chrisomus.*

CHRIST, an appellation synonymous with *Messiah,* usually added to Jesus: and, together therewith, denominating the Saviour of the world. See Christianity and Messiah.

The word χριϛος signifies *anointed,* from χριω, *inungo,* "I anoint." Sometimes the word *Christ* is used singly, by way of *antonomasis,* to denote a person sent from God, as an anointed prophet, king, or priest.

*Order of Christ,* a military order, founded by Dionysius I. king of Portugal, to animate his nobles against the Moors.—The arms of this order are gules, patriarchal cross, charged with another cross argent: they had their residence at first at Castromarin; afterwards they removed to the city of Thomar, as being nearer to the Moors of Andalusia, and Estremadura.

Christ is also the name of a military order in Livonia, instituted in 1205 by Albert bishop of Riga. The end of this institution was to defend the new Christians, who were converted every day in Livonia, but were persecuted by the heathens. They wore on their cloaks a sword with a cross over it, whence they were also denominated *brothers of the sword.*

*Christ-Burgh,* a town of Poland, near the lake Drausen, and about three Polish miles from Marienburgh.

*Christ-Church,* a borough-town of Hampshire, in England, 30 miles south-west of Winchester, near the sea-coast. W. Long. 2. N. Lat. 50. 40. It sends two members to parliament.

*Christ-Thorn,* in botany. See Rhamnus.

CHRISTIAN. See Christianity and Christians.

*Most Christian King,* one of the titles of the king of France.

The French antiquariest race the origin of this appellation up to Gregory the Great, who, writing a letter to Charles Martel, occasionally gave him that title, which his successors have since retained.

*Christian Religion,* that instituted by Jesus Christ. See Christianity.

CHRISTIANITY, the religion of Christians. The word is analogically derived, as other abstracts from their concretes, from the adjective *Christian.* This again is derived from the name Χριϛος, *Christus,* from the word χριω, *I anoint.* Christ is called *the anointed,* from a custom which extensively prevailed in antiquity, and was originally said to be of divine institution, of anointing persons in the sacerdotal or regal character, as a public signal of their consecration to their important offices, and as a testimony that heaven itself was the guarantee of that relation which then commenced between the persons thus consecrated and their subordinates. 1 Origin of the word.

The disciples of Jesus, after the death of their teacher, had for some time been called *Nazarenes,* from Nazareth in Galilee where he dwelt; which afterwards became the designation of a particular sect. They, who adopted the principles and professed the religion which he taught, were first distinguished by the name of *Christians* at Antioch. That profession, and those doctrines, we now proceed to delineate with as much perspicuity as the limits of our plan will admit, yet with the conciseness which a work so multiform and extensive requires. 2 By what name the apostles were first distinguished.

When a Christian is interrogated concerning the nature and foundation of his faith and practice, his ultimate reference, his last appeal, is to the facts, the doctrines, and the injunctions, contained in the books of the Old and New Testament. From these, therefore, and from these alone, must every fair account, or 3 Delineation of Christianity.

the

Christianity.

the materials of which it is composed, be extracted or deduced. Other formularies, or confessions of faith, may, according to the Christian, deserve more or less attention, as they are more or less immediately contained or implied in the scriptures. But whatever is not actually expressed in, or deduced by fair and necessary consequence from, these writings, must be regarded as merely human; and can have no other title to our assent and observation than what they derive from their conformity with the scriptures, with the dictates and feelings of a reformed and cultivated mind, or with those measures which are found expedient and useful in human life. But as those books, from whence the Christian investigates his principles of belief and rules of conduct, have been variously interpreted by different professors and commentators, these diversities have given birth to a multiplicity of different sects. It cannot, therefore, be expected, that any one who undertakes to give an account of Christianity, should comprehend all the writings and opinions which have been propagated and exhibited by historical, systematical, or polemical authors. These, if at all contained in such a work as this, should be ranged under their proper articles, whether scientifical, controversial, or biographical. It is our present business, if possible, to confine ourselves to a detail of such facts and doctrines as in the strict and primitive sense of the word, are *catholic*, or in other expressions, to such as uniformly have been, and still are, recognised and admitted by the whole body of Christians.

4
Account of Christianity, whence deducible.

We have already said that these, or at least the greatest number of them, appeal to the scriptures of the Old and New testament as the ultimate standard, the only infallible rule of faith and manners. If you ask them, by what authority these books claim an absolute right to determine the consciences and understandings of men with regard to what they should believe and what they should do? they will answer you, that all scripture, whether for doctrine, correction, or reproof, was given by immediate inspiration from God.

5
The nature of its evidences.

If again you interrogate them how those books, which they call *Scripture*, are authenticated? they reply, that the evidences by which the Old and New Testament are proved to be the Word of God, are either external or internal. The *external* may again be divided into direct or collateral. The direct evidences are such as arise from the nature, consistency, and probability, of the facts; and from the simplicity, uniformity, competency, and fidelity, of the testimonies by which they are supported. The collateral evidences, are either the same occurences supported by Heathen testimonies, or others which concur with and corroborate the history of Christianity. Its *internal* evidences arise either from its exact conformity with the character of God, from its aptitude to the frame and circumstances of man, or from those supernatural convictions and assistances which are impressed on the mind by the immediate operation of the divine Spirit. These can only be mentioned in a cursory manner in a detail so concise as the present.

6
How Christianity is supported by facts.

Such facts as are related in the history of his religion, the Christian asserts to be not only consistent each with itself, but likewise one with another. Hence it is, that, by a series of antecedents and consequences, they corroborate each other, and form a chain which cannot be broken but by an absolute subversion of all historical authenticity. Nor is this all: for, according to him, the facts on which Christianity is founded, not only constitute a series of themselves, but are likewise in several periods the best resources for supplying the chasms in the history of our nature, and preserving the tenor of its annals entire. The facts themselves are either natural or supernatural. By natural facts we mean such occurrences as happen or may happen from the various operations of mechanical powers, or from the interposition of natural agents without higher assistants. Such are all the common occurrences of history, whether natural, biographical, or civil. By supernatural facts, we mean such as could not have been produced without the interposition of Deity, or at least of powers superior to the laws of mechanism or the agency of embodied spirits. Among these may be reckoned the immediate change of water into wine, the instantaneous cure of diseases without the intervention of medicine, the resuscitation of the dead, and others of the same kind. In this order of occurrences may likewise be numbered the exertions and exhibitions of prophetic power, where the persons by whom these extraordinary talents were displayed could neither by penetration nor conjecture unravel the mazes of futurity, and trace the events of which they spoke from their primary causes to their remote completions. So that they must have been the passive organs of some superior Being, to whom the whole concatenation of causes and effects which operate from the origin to the consummation of nature, was obvious at a glance of thought.

7
Natural facts, what, and how conducive to the elucidation of history.

It has already been hinted, that the facts which we have called *natural*, not only agree with the analogy of human events, and corroborate each other, but in a great many emergencies nobly illustrate the history of nature in general. For this a Christian might offer one instance, of which philosophy will not perhaps be able to produce any tolerable solution, without having recourse to the facts upon which Christianity is founded. For if mankind were originally descended from one pair alone, how should it have happened that long before the date of authentic history every nation had its own distinct language? Or if it be supposed, as some late philosophers have maintained, that man is an indigenous animal in every country; or, that he was originally produced in, and created for, each particular soil and climate which he inhabits; still it may be demanded, whence the prodigious multiplicity, the immense diversity, of languges? Is the language of every nation intuitive, or were they dictated by exigencies, and established by convention? If the last of these suppositions be true, what an immense period of time must have passed? How many revolutions of material and intellectual nature must have happened? What accessions of knowledge, refinement, civilization, must human intercourse have gained before the formation and establishment even of the most simple, imperfect, and barbarous language? Why is a period so vast, obliterated so entirely as to escape the retrospect of history, of tradition, and even of fable itself; Why was the acquisition and improvement of other arts

Christianity.

arts so infinitely distant from that of language, that the aera of the latter is entirely lost, whilst we can trace the former from their origin through the various gradations of their progress.

8 This obscurity inexplicable but by the Mosaic account.

These difficulties, inextricable by all the lights of history or philosophy, this more than Cimmerian darkness, is immediately dissipated by the Mosaic account of the confusion of tongues: wisely intended to separate the tribes of men one from another, to replenish the surface of the globe, and to give its multiplied inhabitants those opportunities of improvement which might be derived from experiment and industry, variously exerted, according to the different situations in which they were placed, and the different employments which these situations dictated. Thus the time of nature's existence is limited to a period within the ken of human intellect. Thus whatever has happened might have happened during the present mode of things; whereas, if we deduce the orign and diversity of language from a period so remotely distant as to be absolutely lost, and entirely detached from all the known occurences and vicissitudes of time, we must admit the present forms and arrangments of things to have subsisted perhaps for a much longer duration than any mechanical philosopher will allow to be possible. Other instances equally pregnant with conviction might be multiplied; but, precluded by the limits of our plan, we proceed to a single observation upon the facts which have been termed *supernatural*.

9 Miracles how conducive to prove the truth of Christianity.

Of those changes which happen in sensible objects, sensation alone can be judge. Reason has nothing to do in the matter. She may draw conclusions from the testimonies of sense, but can never refute them. If, therefore, our senses inform us that snow is white, in vain would the most learned and subtile philosopher endeavour to convince us that it was of a contrary colour. He might confound us, but never could persuade us. Such changes, therefore, as appear to happen in sensible objects, must either be real or fallacious. If real, the miracle is admitted; if falacious, there must be a cause of deception equally unaccountable from the powers of nature, and therefore equally miraculous. If the veracity or competency of the witnesses be questioned, the Christian answers, that they must be competent, because the facts which they relate are not beyond their capacity to determine. They must likewise be faithful, because they had no secular motives for maintaining, but many for suppressing or disguising, what they testified. Now the Christian appeals to the whole series of history and experience, whether such a man is or can be found, as will offer a voluntary, solemn, and deliberate sacrifice of truth at the shrine of caprice.

10 Prophecy evident by its own nature independent of its vehicles.

But such facts as after a long continuance of time have been found exactly agreeable to predictions formerly emitted, must supersede the fidelity of testimony, and infallibly prove that the event was known to the Being by whom it was foretold. In vain has it been urged, that prophecies are ambiguous and equivocal. For though they may prefigure subordinate events, yet if the grand occurrences to which they ultimately relate, can alone fulfil them in their various circumstances, and in their utmost extent, it is plain, that the Being by whom they were revealed must have been actually prescient of those events, and must have had them in view when the predictions were uttered. For this see a learned and ingenious Dissertation on the Credibility of Gospel-history, by Dr M'Knight; where the evidences urged by the Christian in defence of his tenets, which appear detached and scattered through innumerable volumes, are assembled and arranged in such a manner as to derive strength and lustre from the method in which they are disposed, without diminishing the force of each in particular. See also the works of Dr Hurd: consult likewise those of Newton, Sherlock Chandler, &c. For the evidences of those preternatural facts which have been termed *miracles*, the reader may peruse a short but elegant and conclusive defence of these astonishing phenomena, in answer to Mr Hume, by the Rev. George Campbell, D. D.

11 Properties common to all religions.

It must be obvious to every reflecting mind, that whether we attempt to form the idea of any religion *a priori*, or contemplate those which have been already exhibited, certain facts, principles, or *data*, must be pre-established, from whence will result a particular frame of mind and course of action suitable to the character and dignity of that Being by whom the religion is enjoined, and adapted to the nature and situation of those agents who are commanded to observe it. Hence *Christianity* may be divided into *credenda* or doctrines, and *agenda* or precepts.

12 Christian theology.

As the great foundation of his religion, therefore, the Christian believes the existence and government of one eternal and infinite God, who, for ever retains in himself the cause of his own existence, and inherently possesses all those perfections which are compatible with his nature: such are, his almighty power, omniscient wisdom, infinite justice, boundless goodness, perfect holiness, and universal presence. That Jesus Christ is the Son of God, in whom the fulness of the Godhead dwells, by whom he created and governs the universe, exercising in his universal government the energy of the Holy Spirit, and conducting all his dispensations to accomplish the designs of infinite wisdom and benevolence.

The Supreme Being, though absolutely independent and for ever sufficient for his own beatitude, was graciously pleased to create an universe replete with inferior intelligences, who might for ever contemplate and enjoy his glory, participate his happiness, and imitate his perfections. But as freedom of will is essential to the nature of moral agents, that they may cooperate with God in their own improvement and happiness, so their natures and powers are necessarily limited, and by that constitution rendered peccable. This degeneracy first took place in a rank of intelligence superior to man. But guilt is never stationary. Impatient of itself, and cursed with its own feelings, it proceeds from bad to worse, whilst the poignancy of its torments increases with the number of its perpetrations. Such was the situation of Satan, and his apostate angels. They attempted to transfer their turpitude and misery to man; and were, alas! but too successful. Hence the heterogeneous and irreconcileable principles which operate in his nature. Hence that inexplicable medley of wisdom and folly, of rectitude and error, of benevolence and malignity, of sincerity and fraud, exhibited through his whole conduct.

Christianity. duct. Hence the darkneſs of his underſtanding, the depravity of his will, the pollution of his heart, the irregularity of his affections, and the abſolute ſubverſion of his whole internal economy. Theſe ſeeds of perdition ſoon ripened into overt acts of guilt and horror. All the hoſtilities of nature were confronted, and the whole ſublunary creation became a theatre of diſorder and miſchief.

Here the Chriſtian once more appeals to fact and experience. If theſe things are ſo; if *man* is the veſſel of guilt and the victim of miſery; he demands how this conſtitution of things can be accounted for? how can it be ſuppoſed, that a being ſo wicked and unhappy ſhould be the production of an infinitely perfect Creator? He therefore inſiſts, that human nature muſt have been diſarranged and contaminated by ſome violent ſhock; and that, of conſequence, without the light diffuſed over the face of things by Chriſtianity, all nature muſt remain an inſcrutable and inexplicable myſtery.

To redreſs theſe evils, to re-eſtabliſh the empire of virtue and happineſs, to reſtore fallen nature to its primitive rectitude, to purify from every ſtain, to remove the guilt and deſtroy the power of vice, the Son of God, the Logos or Word, the Redeemer or Saviour of the world, the Immanuel or God with us, from whom Chriſtianity takes its name, and to whom it owes its origin, deſcended from the boſom of his Father; was made fleſh; took upon him the form of a ſervant; ; endured a ſevere probation in that character; exhibited a pattern of perfect righteouſneſs; and at laſt ratified his doctrine, and fully accompliſhed all the ends of his miſſion, by a cruel, unmerited, and ignominious death. Before he left this world, he delivered the doctrine of human ſalvation, and the rules of human conduct, to his apoſtles, whom he empowered to inſtruct the world in all that concerned their eternal felicity, and whom he inveſted with miraculous gifts to aſcertain the reality of what they taught. To them he likewiſe promiſed another comforter, even the Divine Spirit, who ſhould relume the darkneſs, conſole the woes, and purify the ſtains,' of human nature. Having remained for a part of three days under the power of death, he aroſe again from the grave, diſcovered himſelf to his diſciples, converſed with them for ſome time, then reaſcended to heaven; from whence the Chriſtian expects him, according to his promiſe, to appear as the Sovereign Judge of the living and the dead, from whoſe award there is no appeal, and by whoſe ſentence the pious and the wicked ſhall receive according to their deeds.

Soon after his departure to the right hand of his Father, where he ſits ſupreme of all created beings, and inveſted with the abſolute adminiſtration of heaven and earth, the Spirit of grace and conſolation deſcended on his apoſtles with viſible ſignatures of divine power and preſence. Nor were his ſalutary operations confined to them, but extended to all the rational world, who did not by obſtinate guilt repel his influences, and provoke him to withdraw them. Theſe, indeed, were leſs conſpicuous than at the glorious æra when they were viſibly exhibited in the perſons of the apoſtles. But though his energy is leſs obſervable, it is by no means leſs effectual to all the purpoſes of grace and mercy.

The Chriſtian is convinced, that there is and ſhall continue to be a ſociety upon earth, who worſhip God as revealed in Jeſus Chriſt; who believe his doctrines; who obſerve his percepts; and who ſhall be ſaved by his death, and by the uſe of theſe external means of ſalvation which he hath appointed.

13 The external means of Chriſtianity, what, and how promotive of their end.

Theſe are few and ſimple. The ſacraments of baptiſm and the euchariſt, the interpretation and application of ſcripture, the habitual exerciſe of public and private devotion, are obviouſly calculated to diffuſe and promote the intereſts of truth and virtue, by ſuperinducing the ſalutary habits of faith, love, and repentance.

The Chriſtian is firmly perſuaded, that at the period which God hath appointed, and to which the purpoſes of providence in the various revolutions of progreſſive nature tend, the whole human race ſhall once more iſſue from their graves; ſome to ſupreme felicity, in the actual perception and enjoyment of their Creator's preſence; others to that conſummate ſhame and miſery, which are the native conſequences of their wickedneſs.

14 Chriſtian morality.

The two grand principles of action, according to the Chriſtian, are, The love of God, which is the ſovereign paſſion in every perfect mind: and the love of man, which regulates our actions according to the various relations in which we ſtand, whether to communities or individuals. This ſacred connection can never be totally extinguiſhed by any temporary injury. It ought to ſubſiſt in ſome degree even amongſt enemies. It requires that we ſhould pardon the offences of others, as we expect pardon for our own; and that we ſhould no farther reſiſt evil than is neceſſary for the preſervation of perſonal rights and ſocial happineſs. It dictates every relative and reciprocal duty between parents and children, maſters and ſervants, governors and ſubjects, friends and friends, men and men. Nor does it merely enjoin the obſervation of equity, but likewiſe inſpires the moſt ſublime and extenſive charity, a boundleſs and diſintereſted effuſion of tenderneſs for the whole ſpecies, which feels their diſtreſs and operates for their relief and improvement. Theſe celeſtial diſpoſitions, and the different duties which are their natural exertions, are the various gradations by which the Chriſtian hopes to attain the perfection of his nature and the moſt exquiſite happineſs of which it is ſuſceptible.

15 This ſyſtem aſſerted by the Chriſtian, ſuperior in the excellence of its nature, and the evidence of its reality, to all others.

Such are the ſpeculative, and ſuch the practical principles of Chriſtianity. From the former, its votaries contend, that the origin, economy, and revolutions of intelligent nature alone can be rationally explained. From the latter, they aſſert, that the nature of man, whether conſidered in its individual or ſocial capacity, can alone be conducted to its higheſt perfection and happineſs. With the determined Atheiſts they ſcarcely deign to expoſtulate. For, according to them, philoſophers who can deduce the origin and conſtitution of things from caſual rencounters or mechanical neceſſity, are capable of deducing any concluſion from any premiſes. Nor can a more glaring inſtance of abſurdity be produced, than the idea of a contingent or ſelf-originated univerſe. When

Deiſts

Christianity.

Deists and other sceptics upbraid them with mysterious or incompatible principles, they without hesitation deny the charge. They demand of any reasoner who admits that a being may be omnipresent without extension; or that he can impress motion upon other things, whilst he himself is necessarily immoveable, upon what ground he charges Christianity with incompatible principles. They ask the sage, why it should be thought more extraordinary, that the Son of God should be sent to this world, that he should be a man of like passions with other men, that he should suffer and die for the relief of his degenerate creatures, than that an existence whose felicity is eternal, inherent, and infinite, should have any motive for creating beings exterior to himself? Is it not, says the Christian, equally worthy of the divine interposition to restore order and happiness where they are lost, as to communicate them where they never have been? Is not infinite goodness equally conspicuous in relieving misery as in diffusing happiness? Is not the existence of what we call evil in the world, under the tuition of an infinitely perfect Being, as inscrutable as the mean exhibited by Christianity for its abolition? The death and resurrection of the Son of God, and pardon and life through him, are certainly not less reconcileable to human reason, *a priori*, than the existence of vice and punishment in the productions of infinite wisdom, power, and goodness: particularly when it is considered, that the virtues exerted and displayed by a perfect Being in a state of humiliation and suffering, shall ultimately be productive of the restored felicity of inferior creatures, in proportion to their glory and excellence; and that such goodness may apply the blessings which it has obtained, in whatever manner, in whatever degree, and to whomsoever it pleases, without being under any necessity to violate the freedom of moral agents, by recalling them to the paths of virtue and happiness by a mechanical and irresistible force.

16
Miraculous as possible, and perhaps as necessary, as natural events.

It will be granted to philosophy by the Christian, that as no theory of mechanical nature can be formed without presupposing sacred and established laws from which she ought rarely or never to deviate, so in fact she tenaciously pursues these general institutions, and from their constant observance result the order and regularity of things. But he cannot admit, that the important ends of moral and intellectual improvement may be uniformly obtained by the same means. He affirms, that if the hand of God should either remain always entirely invisible, or at least only perceptible in the operation of second causes, intelligent beings would be apt in the course of time to resolve the interpositions of Deity into the general laws of mechanism; to forget their connection with nature, and consequently their dependence upon him. Hence, according to the dictates of common sense, and to the unanimous voice of every religion in every age or clime, for the purposes of wisdom and benevolence, God may not only control, but has actually controlled, the common course and general operations of nature. So that, as in the material, world the law of *cause* and *effect* is generally and scrupulously observed for the purposes of natural subsistence and accommodation; thus suspenses and changes of that universal law are equally necessary for the advancement of moral and intellectual perfection.

17
Christianity not only explains the phenomena, but consolesthe miseries, of human nature.

But the disciple of Jesus not only contends, that no system of religion has ever yet been exhibited so consistent with itself, so congruous to philosophy and the common sense of mankind, as Christianity; he likewise avers, that it is infinitely more productive of real and sensible consolation than any other religious or philosophical tenets, which have ever entered into the soul, or been applied to the heart of man. For what is death to that mind which considers eternity as the career of its existence? What are the frowns of fortune to him who claims an eternal world as his inheritance? What is the loss of friends to that heart which feels, with more than natural conviction, that it shall quickly rejoin them in a more tender, intimate, and permanent intercourse than any of which the present life is susceptible? What are the fluctuations and vicissitudes of external things to a mind which strongly and uniformly anticipates a state of endless and immutable felicity? What are mortifications, disappointments, and insults, to a spirit which is conscious of being the original offspring and adopted child of God; which knows that its omnipotent Father will, in proper time, effectually assert the dignity and privileges of its nature? In a word, as earth is but a speck of creation, as time is not an instant in proportion to eternity, such are the hopes and prospects of the Christian in comparison of every sublunary misfortune or difficulty. It is therefore, in his judgment, the eternal wonder of angels, and indelible opprobrium of man, that a religion so worthy of God, so suitable to the frame and circumstances of our nature, so consonant to all the dictates of reason, so friendly to the dignity and improvement of intelligent beings, pregnant with genuine comfort and delight, should be rejected and despised. Were there a possibility of suspence or hesitation between this and any other religion extant, he could freely trust the determination of a question so important to the candid decision of real virtue and impartial philosophy.

18
Mr Gibbon attempts to prove, that the propagation of Christianity was owing to causes from the operation of which no arguments can be deduced in proof of its authenticity.

Mr Gibbon, in his History of the Decline and Fall of the Roman Empire, mentions five secondary causes to which he thinks the propagation of Christianity, and all the remarkable circumstances which attended it, may be with good reason ascribed. He seems to insinuate, that Divine Providence did not act in a singular or extraordinary manner in disseminating the religion of Jesus through the world; and that, if every other argument which has been adduced to prove the sacred authority of this religion can be parried or refuted, nothing can be deduced from this source to prevent it from sharing the same fate with other systems of superstition. The causes of its propagation were in his opinion founded on the principles of human nature and the circumstances of society. If we ascribe not the propagation of Mahometism, or of the doctrines of Zerdust, to an extraordinary interposition of divine providence, operating by an unperceived influence on the dispositions of the human heart, and controlling and confounding the ordinary laws of nature; neither can we, upon any reasonable grounds, refer the promulgation of Christianity to such an interposition.

The

19 The cauſes. The ſecondary cauſes to which he aſcribes theſe effects are, 1. The inflexible and intolerant zeal of the Chriſtians; derived from the Jewiſh religion, but purified from the narrow and unſocial ſpirit which, inſtead of inviting, deterred the Gentiles from embracing the law of Moſes. 2. The doctrine of a future life, improved by every additional circumſtance which could give weight and efficacy to that important truth. 3. The miraculous powers aſcribed to the primitive church. 4. The pure and auſtere morals of the Chriſtians. 5. The union and diſcipline of the Chriſtian republic, which gradually formed an independant and increaſing ſtate in the heart of the Roman empire.

20 Cauſe I. In pointing out the connection between the *firſt* of theſe cauſes and the effects which he repreſents as ariſing from it, this learned and ingenious writer obſerves, that the religion of the Jews does not ſeem to have been intended to be propagated among the Heathens, and that the converſion of proſelytes was rather accidental than conſiſtent with the purport and the general ſpirit of the inſtitutions of Judaiſm. The Jews were, of conſequence, ſtudious to preſerve themſelves a peculiar people. Their zeal for their own religion was intolerant, narrow, and unſocial.

In Chriſtianity, when it made its appearance in the world, all the better part of the predominant ſpirit of Judaiſm was retained; but whatever might have a tendency to confine its influence within narrow limits was laid aſide. Chriſtians were to maintain the doctrines and adhere to the inſtitutions of their religion with ſacred fidelity. They were not to violate their allegiance to Jeſus by entertaining or profeſſing any reverence for Jupiter or any other of the Heathen deities; it was not even neceſſary for them to comply with the poſitive and ceremonial inſtitutions of the law of Moſes,—although theſe were acknowledged to have been of divine origin. The zeal, therefore, which their religion inculcated, was inflexible. It was even intolerant: for they were not to content themſelves with profeſſing Chriſtianity and conforming to its laws; they were to labour with unremitting aſſiduity, and to expoſe themſelves to every difficulty and every danger, in converting others to the ſame faith.

But the ſame circumſtances which rendered it thus intolerant, communicated to it a more liberal and a leſs unſocial ſpirit than that of Judaiſm. The religion of the Jews was intended only for a few tribes: Chriſtianity was to become a catholic religion; its advantages were to be offered to all mankind.

All the different ſects which aroſe among the primitive Chriſtians uniformly maintained the ſame zeal for the propagation of their own religion, and the ſame abhorrence for every other. The Orthodox, the Ebionites, the Gnoſtics, were all equally animated with the ſame excluſive zeal, and the ſame abhorrence of idolatry, which had diſtinguiſhed the Jews from other nations.

21 Obſervations in anſwer. Such is the general purport of what Mr Gibbon advances concerning the influence of the firſt of thoſe ſecondary cauſes in the propagation of Chriſtianity. It would be uncandid to deny, that his ſtatement of facts appears to be, in this inſtance, almoſt fair, and his deductions tolerably logical. The firſt Chriſtians *were* remarkable for their deteſtation of idolatry, and for the generous diſintereſted zeal with which they laboured to convert others to the ſame faith. The firſt of theſe principles, no doubt, contributed to maintain the dignity and the purity of Chriſtianity; and the ſecond to diſſeminate it through the world. But the facts which he relates are ſcarce conſiſtent throughout. He ſeems to repreſent the zeal of the firſt Chriſtians as ſo hot and intolerant, that they could have no ſocial intercourſe with thoſe who ſtill adhered to the worſhip of Heathen deities. In this caſe, how could they propagate their religion? Nay, we may even aſk, How could they live? If they could not mingle with the Heathens in the tranſactions either of peace or war; nor witneſs the marriage or the funeral of the deareſt friend, if a Heathen; nor practiſe the elegant arts of muſic, painting, eloquence, or poetry; nor venture to uſe freely in converſation the language of Greece or of Rome:—it is not eaſy to ſee what opportunities they could have of diſſeminating their religious ſentiments. If, in ſuch circumſtances, and obſerving rigidly ſuch a tenor of conduct, they were yet able to propagate their religion with ſuch amazing ſucceſs as they are ſaid to have done; they muſt ſurely either have practiſed ſome wondrous arts unknown to us, or have been aſſiſted by the ſupernatural operation of divine power.

But all the hiſtorical records of that period, whether ſacred or profane, concur to prove, that the primitive Chriſtians in general did not retire with ſuch religious horror from all intercourſe with the Heathens. They refuſed not to ſerve in the armies of the Roman empire: They appealed to Heathen magiſtrates, and ſubmitted reſpectfully to their deciſions: the Huſband was often a Heathen, and the wife a Chriſtian; or, again, the huſband a Chriſtian, and the wife a Heathen. Theſe are facts ſo univerſally known and believed, that we need not quote authorities in proof of them.

This reſpectable writer appears therefore not to have ſtated the facts which he produces under this head with ſufficient ingenuouſneſs; and he has taken care to exaggerate and improve thoſe which he thinks uſeful to his purpoſe with all the dazzling, deluſive colours of eloquence. But had the zeal of the firſt Chriſtians been ſo intolerant as he repreſents it, it muſt have been highly unfavourable to the propagation of their religion: all their wiſhes to make converts would, in that caſe, have been counteracted by their unwillingneſs to mix, in the ordinary intercourſe of life, with thoſe who were to be converted. Their zeal, and the liberal ſpirit of their religion, were indeed ſecondary cauſes which contributed to its propagation: but their zeal was by no means ſo ridiculouſly intolerant as this writer would have us believe; if it had, it muſt have produced effects directly oppoſite to thoſe which he aſcribes to it.

In illuſtrating the influence of the *Second* of theſe ſecondary cauſes to which he aſcribes the propagation of Chriſtianity, Mr Gibbon diſplays no leſs ingenuity than in tracing the nature and the effects of the firſt. The doctrine of a future life, improved by every additional circumſtance which can give weight and efficacy to that important truth, makes a conſpicuous figure in the Chriſtian ſyſtem; and it is a doctrine highly flattering to the natural hopes and wiſhes of the human heart. 22 Cauſe II.

Though the Heathen philoſophers were not unacquainted with this doctrine; yet to them the ſpirituality of the human ſoul, its capacity of exiſtence in a ſeparate ſtate from the body, its immortality, and its pro-

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prospect of lasting happiness in a future life, rather appeared things possible and desirable, than truths fully established upon solid grounds. These doctrines, Mr Gibbon would persuade us, had no influence on the moral sentiments and general conduct of the Heathens. Even the philosophers, who amused themselves with displaying their eloquence and ingenuity on those splendid themes, did not allow them to influence the tenor of their lives. The great body of the people, who were occupied in pursuits very different from the speculations of philosophy, and were unacquainted with the questions discussed in the schools, were scarce ever at pains to reflect whether they consisted of a material and a spiritual part, or whether their existence was to be prolonged beyond the term of the present life; and they could not regulate their lives by principles which they did not know.

In the popular superstition of the Greeks and Romans, the doctrine of a future state was not omitted. Mankind were not only flattered with the hopes of continuing to exist beyond the term of the present life; but different conditions of existence were promised or threatened, in which retributions for their conduct in human life were to be enjoyed or suffered. Some were exalted to heaven, and associated with the gods; others were rewarded with less illustrious honours, and a more moderate state of happiness, in Elysium; and those, again, who by their conduct in life had not merited rewards, but punishments, were consigned to Tartarus. Such were the ideas of a future state which made a part of the popular superstition of the Greeks and Romans. But they produced only a very faint impression on the minds of those among whom they prevailed. They were not truths supported by evidence; they were not even plausible; they were a tissue of absurdities. They had not therefore a more powerful influence on the morals, than the more refined speculations of the philosophers.

Even the Jews, whose religion and legislature were communicated from heaven, were in general, till within a very short time before the propagation of the gospel, as imperfectly acquainted with the doctrine of a future state as the Greeks and Romans. This doctrine made no part of the law of Moses. It is but darkly and doubtfully insinuated through the other parts of the Old Testament. Those among the Jews who treated the sacred scriptures with the highest reverence, always denied that such a doctrine could be deduced from any thing which these taught; and maintained that death is the final dissolution of man.

The rude tribes who inhabited ancient Gaul, and some other nations not more civilized than they, entertained ideas of a future life, much clearer than those of the Greeks, the Romans, or the Jews.

Christianity, however, explained and inculcated the truth of this doctrine in all its splendor and all its dignity. It exhibited an alluring, yet not absurd, view of the happiness of a future life. It conferred new horrors on the place of punishment, and added new severity to the tortures to be inflicted, in another world. The authority on which it taught these doctrines, and displayed these views, was such as to silence inquiry and doubt, and to command implicit belief. What added to the influence of the doctrine of a future state of existence, thus explained and inculcated, was, that the first Christians confidently prophesied and sincerely believed that the end of the world, the consummation of all things, was fast approaching, and that the generation then present should live to witness that awful event. Another circumstance which contributed to render the same doctrine so favourable to the propagation of Christianity was, that the first Christians dealt damnation without remorse, and almost without making any exceptions, on all who died in the belief of the absurdities of Heathen superstition. Thus taught and improved with these additional and heightening circumstances, this doctrine, partly by presenting alluring prospects and exciting pleasing hopes, partly by working upon the fears of the human heart with representations of terror, operated in the most powerful manner in extending the influence of the Christian faith.

23 Observations in answer.

Here, too, facts are rather exaggerated, and the inferences scarce fairly deduced. It must be confessed, that the speculations of the Heathen philosophers did not fully and undeniably establish the doctrine of the immortality of the human soul; nor can we presume to assert, in contradiction to Mr Gibbon, that their arguments could impress such a conviction of this truth as might influence in a very strong degree the moral sentiments and conduct. They must, however, have produced some influence on these. Some of the most illustrious among the Heathen philosophers appear to have been so strongly impressed with the belief of the soul's immortality, and of a future state of retribution, that their general conduct was constantly and in a high degree influenced by that belief. Plato and Socrates are eminent and well known instances. And if, in such instances as these, the belief of these truths produced such conspicuous effects; it might be fairly inferred, though we had no farther evidence, that those characters were far from being singular in this respect. It is a truth acknowledged as unquestionable in the history of the arts and sciences, that wherever any one person has cultivated these with extraordinary success, some among his contemporaries will always be found to have rivalled his excellence, and a number of them to have been engaged in the same pursuits. On this occasion we may venture, without hesitation, to reason upon the same principles. When the belief of the immortality of the human soul produced such illustrious patterns of virtue as a Plato and a Socrates; it must certainly have influenced the moral sentiments and conduct of many others,—although in an inferior degree. We speculate, we doubt, concerning the truth of many doctrines of Christianity; many who profess that they believe them, make this profession only because they have never considered seriously whether they be true or false. But, notwithstanding this, these truths still exert a powerful influence on the sentiments and manners of society in general. Thus, also, it appears, that the doctrines of ancient philosophy concerning a future life, and even the notions concerning Olympus, Elysium, and Tartarus, which made a part of the popular superstition, *did* produce a certain influence on the sentiments and manners of the heathens in general. That influence was often indeed inconsiderable, and not always happy; but still it was somewhat greater than Mr Gibbon seems willing to allow. Christians have been sometimes at pains to exaggerate the absurdities of Pagan superstition, in order that the advantages

vantages of Christianity might acquire new value from being contrasted with it. Here we find one who is rather disposed to be the enemy of Christianity, displaying, and even exaggerating, those absurdities for a very different purpose. But the truth may be safely admitted: it is only when exaggerated that it can serve any purpose inimical to the sacred authority of our holy religion. Mr Gibbon certainly represents the religious doctrine of the ancient Gauls, in respect to the immortality of the human soul and a future state, in too favourable a light. It is only because the whole system of superstition which prevailed among those barbarians is so imperfectly known, that it has been imagined to consist of more sublime doctrines than those of the popular superstition of the Greeks and Romans. The evidence which Mr Gibbon adduces in proof of what he asserts concerning these opinions of the ancient Gauls, is partial, and far from satisfactory. They *did* indeed assert and believe the soul to be immortal; but this doctrine was blended among a number of absurdities much grosser than those which characterise the popular religion of the Greeks and Romans. The latter was the superstition of a civilized people, among whom reason was unfolded and improved by cultivation, and whose manners were polished and liberal; the former was that of barbarians, among whom reason was, as it were, in its infancy, and who were strangers to the improvements of civilization. When hasty observers found that those barbarians were not absolutely strangers to the idea of immortality, they were moved to undue admiration; their surprise at finding what they had not expected, confounded their understanding, and led them to misconceive and misrepresent. What we ought to ascribe to the savage ferocity of the character of those rude tribes, has been attributed by mistake to the influence of their belief of a future state.

In the law of Moses, it must be allowed, that this doctrine is not particularly explained nor earnestly inculcated. The author of the Divine Legation of Moses, &c. has founded upon this fact an ingenious theory, which we shall elsewhere have occasion to examine. The reasons why this doctrine was not more fully explained to the Jews, we cannot pretend to assign, at least in this place; yet we cannot help thinking, that it was more generally known among the Jews than Mr Gibbon and the author of the Divine Legation are willing to allow. Though it be not strongly inculcated in their *code of laws*, yet there is some reason to think that it was known and generally prevalent among them long before the Babylonish captivity; even in different passages in the writings of Moses, it is mentioned or alluded to in an unequivocal manner. In the history of the patriarchs, it appears that this doctrine was known to *them;* it appears to have had a strong influence on the mind of Moses himself. Was David, was Soloman, a stranger to this doctrine? We cannot here descend to very minute particulars; but surely all the efforts of ingenuity must be insufficient to torture the sacred scriptures of the Old Testament, so as to prove that they contain nothing concerning the doctrine of a future state any where but in the writings of the latter prophets, and that even in these it is only darkly insinuated. Were the Jews, in the earlier part of their history, so totally secluded from all intercourse with other nations, that a doctrine of so much importance, more or less known to all around, could not be communicated to them? The Pharisees *did* admit traditions, and set upon them an undue value; yet they appear to have been considered as the most orthodox of the different sects which prevailed among the Jews: the Sadducees were rather regarded as innovators.

But though we are of opinion, that this ingenious writer allows to the doctrine of the Greek and Roman philosophers, concerning the immortality of the human soul, as well as to the notions concerning a future state which made a part of the popular superstitions of those nations, less influence on the moral sentiments and conduct of mankind than what they really exerted; though we cannot agree with him in allowing the ideas of the immortality of the soul and of a future state, which were entertained by the Gauls and some other rude nations, to have been much superior in their nature, or much happier in their influence, than those of the Greeks and Romans; and though, in consequence of reading the Old testament, we are disposed to think that the Jews knew somewhat more concerning the immortality of the human soul, and concerning the future state in which human beings are distined to exist, than Mr Gibbon represents them to have known; yet still we are very sensible, and very well pleased to admit, that "life and immortality were brought to light through the gospel."

The doctrine of a future life, as it was preached by the first Christians, was established on a more solid basis than that on which it had been before maintained; was freed from every absurdity; and was, in short, so much improved, that its influence, which, as it was explained by Heathen poets and philosophers, must be confessed to have been in many instances doubtful, now became favourable only to the interests of piety and virtue, and to them in a very high degree. It undoubtedly contributed to the successful propagation of Christianity; for it was calculated to attract and please both the speculating philosopher and the simple unenlightened votary of the vulgar superstition. The views which it exhibited were distinct; and all was plausible and rational, and demonstrated by the fullest evidence. But the happiness which it promised was of a less sensual nature than the enjoyments which the Heathens expected on Olympus or in Elysium; and would therefore appear less alluring to those who were not very capable of refined ideas, or preferred the gratification of the senses in the present life to every other species of good. If the first Christians rejoiced in the hope of beholding all the votaries of Pagan idolatry afflicted with the torments of hell in a future state, and boasted of these hopes with inhuman exultation, they would in all probability rather irritate than alarm those whom they sought to convert from that superstition: the Heathens would be moved to regard with indignant scorn the preacher who pretended, that those whom they venerated as gods, heroes, and wise men, were condemned to a state of unspeakable and lasting torment. Would not every feeling of the heart revolt against the idea, that a parent, a child, a husband, a wife, a friend, a lover, or a mistress, but lately lost, and still lamented, was consigned to eternal torments for actions and opinions which they had deemed highly agreeable to superior powers?

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We may conclude, then, with respect to the influence of this secondary cause in promoting the propagation of Christianity, that the circumstances of the Heathen world was less favourable to that influence than Mr Gibbon pretends; that the means by which he represents the primitive Christians, as improving its efficacy, were some of them not employed, and others rather likely to weaken than to strengthen it; and that therefore more is attributed to the operation of this cause than it could possibly produce.

Cause III.

The *third cause*, the miraculous powers of the primitive church, is with good reason represented as having conduced very often to the conviction of infidels. Mr Gibbon's reasonings under this head are, That numerous miraculous works of the most extraordinary kind were ostentatiously performed by the first Christians: that, however, from the difficulty of fixing the period at which miraculous powers ceased to be communicated to the Christian church, and from some other circumstances, there is reason to suspect them to have been merely the pretences of imposture; but this (to use a phrase of his own) is only darkly insinuated: and lastly, that the Heathens having been happily prepared to receive them as real by the many wonders nearly of a similar nature to which they were accustomed in their former superstition, the miracles which the first Christians employed to give a sanction to their doctrines, contributed in the most effectual manner to the propagation of Christianity.

Observations in reply.

In reply to what is here advanced, it may be suggested, that the miracles recorded in the New Testament, as having been performed by the first Christians when engaged in propagating their religion, as well as a number of others recorded by the Fathers, are established as true, upon the most indubitable evidence which human testimony can afford for any fact. An ingenious Scotch writer *, who was to fond of employing his ingenuity in undermining truths generally received, has endeavoured to prove that no human testimony, however strong and unexceptionable, can afford sufficient evidence of the reality of a miracle. But his reasonings on this head, which once excited doubt and wonder, have been since completely refuted; and mankind still continue to acknowledge, that though we are all liable to mistakes and capable of deceit, yet human testimony *may* afford the most convincing evidence of the most extraordinary and even supernatural facts. The reader will not expect us to enter, in this place, into a particular examination of the miracles of our Saviour, and his apostles, and the primitive church. An enquiry into these will be a capital object in another part of this work (THEOLOGY). We may here consider it as an undeniable and a generally acknowledged fact, that a certain part of those miracles were real. Such as were real, undoubtedly contributed, in a very eminent manner, to the propagation of Christianity; but they are not to be ranked among the natural and *secondary* causes.

* Mr *Hume*.

It is difficult to distinguish at what period miraculous gifts ceased to be conferred on the members of the primitive church; yet we *may* distinguish, if we take pains to inquire with minute attention, at what period the evidence ceases to be satisfactory. We can also by considering the circumstances of the church through the several stages of its history, form some judgment concerning the period during which the gifts of prophesying, and speaking with tongues, and working miracles, were most necessary to Christians to enable them to assert the truth and dignity of their religion.

The Heathens were no strangers to pretended miracles and prophecies, and other seeming interpositions of superior beings, disturbing the ordinary course of nature and of human affairs: but the miracles to which they were familiarised had been so often detected to be tricks of imposture or pretences of mad enthusiasm, that, instead of being prepared to witness or to receive accounts of new miracles with easy credulity, they must have been in general disposed to view them with jealousy and suspicion. Besides, the miracles to which they had been accustomed, and those performed by the apostles and the first preachers of Christianity, were directly contradictory; and therefore the one could receive no assistance from the other.

Yet we must acknowledge, notwithstanding what we have above advanced, that as disagreements with respect to the principles and institutions of their religion very early arose among Christians; so they likewise sought to extend its influence, at a very early period, by the use of *pious frauds*. Pious frauds, too, appear to have sometimes served the immediate purposes for which they were employed, though eventually they have been highly injurious to the cause of Christianity.

We conclude, then, that Christianity *was* indebted to the influence of miracles in a considerable degree for its propagation: but that the real miracles of our Saviour and his apostles, &c. were not among the *secondary* causes of its success: that the Heathens who were to be converted were not very happily prepared for receiving the miracles of the gospel with blind credulity: that, as it is possible to discern between sufficient and insufficient evidence, so it is not more difficult to distinguish between true and false miracles: and, lastly, that false miracles were soon employed by Christians as engines to support and propagate their religion, and perhaps not unsuccessfully; but were, upon the whole, more injurious than serviceable to the cause which they were called in to maintain.

Cause IV.

The *fourth of this series of secondary causes*, which this author thinks to have been adequate to the propagation of Christianity, is the virtues of the primitive Christians. These he is willing to attribute to other and less generous motives, rather than to the pure influence of the doctrines and precepts of their religion.

The first converts to Christianity were most of them from among the lowest and most worthless characters. The wise, the mighty, and those who were distinguished by specious virtues, were in general perfectly satisfied with theeir present circumstances and future prospects. People whose minds were naturally weak, unenlightened, or oppressed with the sense of atrocious guilt, and who were infamous or outcasts from society, were eager to grasp at the hopes which the gospel held out to them.

When, after enlisting under the banner of Christ, they began to consider themselves as "born again to newness of life; remorse and fear, which easily prevail over weak minds; selfish hopes of regaining their reputation, and attaining to the honours and happiness of those mansions which Jesus was said to have gone to prepare;

Christianity.

prepare; with a desire to raise the honour and extend the influence of the society of which they were become members; all together operated so powerfully as to enable them to display both active and passive virtue in a very extraordinary degree. Their virtues did not flow from the purest and noblest source; yet they attracted the notice and moved the admiration of mankind. Of those who admired, some were eager to imitate; and, in order to that, thought it necessary to adopt the same principles of action.

Their virtues too, were rather of that species which excite wonder, because uncommon, and not of essential utility in the ordinary intercourse of society; than of those which are indispensably necessary to the existence of social order, and contribute to the ease and convenience of life. Such virtues were well calculated to engage the imitation of those who had failed egregiously in the practice of the more social virtues.

Thus they practised extraordinary, but useless and unsocial, virtues, upon no very generous motives; and those virtues drew upon them the eyes of the world, and induced numbers to embrace their faith.

Observations, in answer.

We must, however unwillingly, declare, that this is plainly an uncandid account of the virtues of the primitive Christians, and the motives from which they originated. The social virtues are strongly recommended through the gospel. No degree of mortification or self-denial, or seclusion from the ordinary business and amusements of social life, was required of the early converts to Christianity; save what was indispensably necessary to wean them from the irregular habits in which they had before indulged, and which had rendered them nuisances in society, and to form them to new habits equally necessary to their happiness and their usefulness in life. We allow that they practised virtues which in other circumstances would, however splendid, have been unnecessary. But in the difficult circumstances in which the first Christians were placed, the virtues which they practised were in the highest degree social. The most prominent feature in their character was, "their continuing to entertain sentiments of generous benevolence, and to discharge scrupulously all the social duties," towards those who exercised neither charity nor humanity, and frequently not even bare integrity and justice, in their conduct towards them.

It cannot be said with truth, that such a proportion of the primitive Christian were people whose characters had been infamous and their circumstances desperate, as that the character of the religion which they embraced can suffer from this circumstance. Nor were they *only* the weak and illiterate whom the apostles and their immediate successors converted by their preaching. The criminal, to be sure, rejoiced to hear that he might obtain absolution of his crimes; the mourner was willing to receive comfort; minds of refined and generous feelings were deeply affected with that goodness which had induced the Son of God to submit to suffer and die for sinners: but the simplicity, the rationality, and the beauty of the Christian system, likewise prevailed in numerous instances over the pride and prejudices of the great and the wise; in so many instances, as are sufficient to vindicate the Christian church from the aspersion by which it has been represented, as being in the first period of its existence merely a body of *criminals and idiots*.

The principles, too, from which the virtues of the first Christians originated, were not peculiarly mean and selfish; nay, they seem to have been uncommonly sublime and disinterested. Remorse in the guilty mind is a natural and reasonable sentiment; the desire of happiness in every human breast is equally so. It is uncandid to cavil against the first Christians for being, like the rest of mankind, influenced by these sentiments: And when we behold them overlooking temporary possessions and enjoyments, extending their views to futurity, and "living by faith;" when we observe them "doing good to those who hated them, blessing those who cursed them, and praying for those by whom they were despitefully used;" can we deny their virtues to have been of the most generous and disinterested kind?

We allow, then, that the virtues of the first Christians must have contributed to the propagation of their religion: but it is with pain that we observe this respectable writer studiously labouring to misrepresent the principles from which those virtues arose; and not only the principles from which they arose, but also their importance in society.

Cause V. with observations.

The *fifth cause* was the mode of church government adopted by the first Christians, by which they were knit together in one society; who preferred the church and its interests to their country and civil concerns. We wish not to deny, that the mutual attachment of the primitive Christians contributed to spread the influence of their religion; and the order which they maintained, in consequence of being animated with this spirit of brotherly love, and with such ardent zeal for the glory of God, must no doubt have produced no less happy effects among them than order and regularity produce on every other occasion on which they are strictly observed. But whether the form of church-government, which was gradually established in the Christian church, was actually the happiest that could possibly have been adopted; or whether, by establishing a distinct society, with separate interests, within the Roman empire, it contributed to the dissolution of that mighty fabric, we cannot here pretend to inquire. These are subjects of discussion, with respect to which we may with more propriety endeavour to satisfy our readers elsewhere.

General conclusion concerning the influence of the five causes.

From the whole of this review of what Mr Gibbon has so speciously advanced concerning the influence of these five secondary causes in the propagation of the gospel, we think ourselves warranted to conclude, That the zeal of the first Christians was not, as he represents it, intolerant: That the doctrine of the immortality of the human soul was somewhat better understood in the heathen world, particularly among the Greeks and Romans and the Jews, than he represents it to have been; and had an influence somewhat happier than what he ascribes to it: That the additional circumstances by which, he tells us, the first preachers of Christianity improved the effects of this doctrine, were far from being calculated to allure converts: That the heathens, therefore, were not quite so well prepared for an eager reception of this doctrine as he would persuade us they were; and, of consequence, could not be influenced by it in so considerable a degree, in their conversion: That real, unquestionable miracles, performed by our Saviour, by his apostles, and by by their successors, *did* contribute signally to the propagation of Christianity; but are not to be ranked among the *secondary* causes: That weakness and blind zeal did at times employ pretended miracles for the same purpose not altogether ineffectually: That though these despicable and wicked means might be in some instances successful; yet they were, upon the whole, much more injurious than beneficial: That the virtues of the primitive Christians arose from the most generous and noble motives, and were in their nature and tendency highly favourable to social order, and to the comfort of mankind in the social state: And, lastly, That the order and regularity of church-government, which were gradually established among the first Christians, contributed greatly to maintain the dignity and spread the influence of their religion; but do not appear to have disjoined them from their fellow-subjects or to have rendered them inimical to the welfare of the state of which they were members.

Upon the whole, then, we do not see that these secondary causes were equal to the effects that have been ascribed to them; and it seems undeniable, that others of a superior kind co-operated with them. We earnestly recommend to the perusal of the reader a valuable performance of Lord Hailes's, in which he enquires into Mr Gibbon's assertions and reasonings, concerning the influence of these five causes, with the utmost accuracy of information, strength and clearness of reasoning, and elegant simplicity of style, and without virulence or passion.

CHRISTIANS, those who profess the religion of Christ: See CHRISTIANITY and MESSIAH.—The name *Christian* was first given at Antioch in the year 42 to such as believed in Christ, as we read in the Acts: till that time they were called *disciples*.

The first Christians distinguished themselves in the most remarkable manner by their conduct and their virtues. The faithful, whom the preaching of St Peter had converted, hearkened attentively to the exhortations of the Apostles, who failed not carefully to instruct them, as persons who were entering upon an entirely new life. They went every day to the temple with one heart and one mind, and continued in prayers; doing nothing different from the other Jews, because it was yet not time to separate from them. But they made a still greater progress in virtue; for they sold all that they possessed, and distributed their goods in proportion to the wants of their brethren. They *eat their meat with gladness and singleness of heart, praising God, and having favour with all the people.* St Chrysostom, examining from what source the eminent virtue of the first Christians flowed, ascribes it principally to their divesting themselves of their possessions; "For "(says that father) persons from whom all that they "have is taken away, are not subject to sin: whereas, "whoever has large possessions, wants not a devil or a "tempter to draw him into hell by a thousand ways."

The Jews were the first and the most inveterate enemies the Christians had. They put them to death as often as they had it in their power: and when they revolted against the Romans in the time of the emperor Adrian, Barchochebas, the head of that revolt, employed against the Christians the most rigorous punishments to compel them to blaspheme and renounce Jesus Christ. And we find that, even in the third century, they endeavoured to get into their hands Christian women, in order to scourge and stone them in their synagogues. They cursed the Christians solemnly three times a-day in their synagogues, and their rabbins would not suffer them to converse with Christians upon any occasion. Nor were they contented to hate and detest them; but they dispatched emissaries all over the world to defame the Christians, and spread all sorts of calumnies against them. They accused them, among other things, of worshipping the sun and the head of an ass. They reproached them with idleness, and being an useless race of people. They charged them with treason, and endeavouring to erect a new monarchy against that of the Romans. They affirmed, that, in celebrating their mysteries, they used to kill a child and eat its flesh. They accused them of the most shocking incests, and of intemperance in their feasts of charity. But the lives and behaviour of the first Christians were sufficient to refute all that was said against them, and evidently demonstrated that these accusations were mere calumny and the effect of inveterate malice.

Pliny the younger, who was governor of Pontus and Bithynia between the years 103 and 105, gives a very particular account of the Christians in that province, in a letter which he wrote to the emperor Trajan, of which the following is an extract: "I take "the liberty, Sir, to give you an account of every "difficulty which arises to me. I have never been "present at the examination of the Christians; for "which reason I know not what questions have been "put to them, nor in what manner they have been "punished. My behaviour towards those who have "been accused to me has been this: I have interro- "gated them, in order to know whether they were "really Christians. When they have confessed it, I "have repeated the same question two or three "times, threatening them with death if they did "not renounce this religion. Those who have per- "sisted in their confession, have been, by my order, "led to punishment. I have even met with some "Roman citizens guilty of this phrensy, whom, in "regard to their quality, I have set apart from the "rest, in order to send them to Rome. These per- "sons declare, that their whole crime, if they are "guilty, consists in this; that, on certain days, they "assemble before sun-rise, to sing alternately the "praises of Christ, as of a God, and to oblige them- "selves, by the performance of their religious rites, "not to be guilty of theft, or adultery, to observe in- "violably their word, and to be true to their trust. "This deposition has obliged me to endeavour to in- "form myself still farther of this matter, by putting "to the torture two of their women-servants, whom "they call *deaconesses*: but I could learn nothing "more from them, than that the superstition of these "people is as ridiculous as their attachment to it is "astonishing."

There is extant a justification, or rather panegyric, of the Christians, pronounced by the mouth of a Pagan prince. It is a letter of the emperor Antoninus, written in the year 152, in answer to the States of Asia, who had accused the Christians of being the cause of some earthquakes which had happened in that part of the world. The emperor advises them to "take care, lest, in torturing and punishing those whom they accused of Atheism (meaning the Chri-

Christians.

stians), they should render them more obstinate, instead of prevailing upon them to change their opinion; since their religion taught them to suffer with pleasure for the sake of God." As to the earthquakes which had happened, he puts them in mind," that they themselves are always discouraged, and sink under such misfortunes; whereas the Christians never discovered more cheerfulness and confidence in God than upon such occasions." He tells them, that "they pay no regard to religion, neglect the worship of the Eternal; and, because the Christians honour and adore Him, therefore they are jealous of them, and persecute them even to death." He concludes: "Many of the governors of provinces have formerly written to my father concerning them; and his answer always was, that they should not be molested or disturbed, provided they quietly submitted to the authority of the government. Many persons have likewise consulted me upon this affair, and I have returned the same answer to them all; namely, that if any one accuses a Christian merely on account of his religion, the accused person shall be acquitted, and the accuser himself punished." This ordinance, according to Eusebius, was publicly fixed up at Ephesus in an assembly of the states.

It is no difficult matter to discover the causes of the many persecutions, to which the Christians were exposed during the three first centuries. The purity of the Christian morality, directly opposite to the corruption of the Pagans, was doubtless one of the most powerful motives of the public aversion. To this may be added, the many calumnies unjustly spread about concerning them by their enemies, particularly the Jews. And this occasioned so strong a prejudice against them, that the Pagans condemned them without inquiring into their doctrine, or permitting them to defend themselves. Besides, their worshipping Jesus Christ, as God, was contrary to one of the most ancient laws of the Roman empire, which expresly forbad the acknowledging of any God which had not been approved by the senate.

But notwithstanding the violent opposition made to the establishment of the Christian religion, it gained ground daily, and very soon made a surprising progress in the Roman empire. In the third century, there were Christians in the camp, in the senate, in the palace; in short every where, but in the temples and the theatres: they filled the towns, the country, the islands. Men and women, of all ages and conditions, and even those of the first dignities, embraced the faith; insomuch that the Pagans complained that the revenues of their temples were ruined. They were in such great numbers in the empire, that (as Tertullian expresses it) were they to have retired into another country, they would have left the Romans only a frightful solitude.

The primitive Christians were not only remarkable for the practice of every virtue; they were also very eminently distinguished by the many miraculous gifts and graces bestowed by God upon them. "Some of the Christians (says Irenæus) drive out devils, not in appearance only, but so as that they never return; whence it often happens, that those who are dispossessed of evil spirits embrace the faith and are received into the church. Others know what is to come, see visions, and deliver oracles as prophets. Others heal the sick by laying their hands on them, and restore them to perfect health: and we find some who even raise the dead.——It is impossible to reckon up the gifts and graces which the church has received from God—what they have freely received they as freely bestow. They obtain these gifts by prayer alone, and invocation, of the name of Jesus Christ, without any mixture of enchantment or superstition."

Christians.

We shall here subjoin the remarkable story, attested by Pagan authors themselves, concerning the *Christian Legion* in the army of the emperor Marcus Aurelius. That prince having led his forces against the Quadi, a people on the other side of the Danube, was surrounded and hemmed in by the enemy in a disadvantageous place, and where they could find no water. The Romans were greatly embarrassed, and, being pressed by the enemy, were obliged to continue under arms, exposed to the violent heat of the sun, and almost dead with thirst; when, on a sudden, the clouds gathered, and the rain fell in great abundance. The soldiers received the water in their bucklers and helmets, and satisfied both their own thirst and that of their horses. The enemy, presently after, attacked them; and so great was the advantage they had over them, that the Romans must have been overthrown, had not heaven again interposed by a violent storm of hail, mixed with lightning, which fell on the enemy, and obliged them to retreat. It was found afterwards, that one of the legions, which consisted of Christians, had by their prayers, which they offered up on their knees before the battle, obtained this favour from heaven: and from this event that legion was sirnamed *The thundering Legion*. See, however, the criticism of Mr *Moyle* on this story in his *Works*, vol.ii. p. 81—390. See also *Mosheim's Church History*, vol. i. p. 124.

Such were the primitive Christians, whose religion has by degrees spread itself over all parts of the world, though not with equal purity in all. And though, by the providence of God, Mahometans and Idolaters have been suffered to possess themselves of those places in Greece, Asia, and Africa, where the Christian religion formerly most flourished; yet there are still such remains of the Christian religion among them as to give them opportunity sufficient to be converted. For, in the dominions of the Turk in Europe, the Christians make two third parts at least of the inhabitants: and in Constantinople itself there are above twenty Christian churches, and above thirty in Thessalonica. Philadelphia, now called *Ala-shahir*, has no fewer than twelve Christian churches. The whole island of Chio is governed by Christians; and some islands of the Archipelago are inhabited by Christians only. In Africa, besides the Christians living in Egypt, and in the kingdom of Congo and Angola, the islands upon the western coasts are inhabited by Christians; and the vast kingdom of Abyssinia, supposed to be as big as Germany, France, Spain, and Italy, put together, is possessed by Christians. In Asia, most part of the empire of Russia, the countries of Circassia and Mingrelia, Georgia, and Mount Libanus, are inhabited only by Christians. In America, it is notorious that the Christians are very numerous, and spread over most parts of that vast continent.

*Christians of St John*, a sect of Christians very numerous in Balsara and the neighbouring towns: they formerly

formerly inhabited along the river Jordan, where St John baptized, and it was from thence they had their name. They hold an anniversary feast of five days; during which they all go to the bishop, who baptizes them with the baptism of St John. Their baptism is also performed in rivers, and that only on Sundays: they have no notion of the third Person in the Trinity; nor have they any canonical books, but abundance full of charms, &c. Their bishoprics descend by inheritance, as our estates do, though they have the ceremony of an election.

*Christians of St Thomas*, a sort of Christians in a peninsula of India on this side of the Gulf: they inhabit chiefly at Cranganor, and the neighbouring country: these admit of no images; and receive only the cross, to which they pay a great veneration: they affirm, that the souls of the saints do not see God till after the day of judgement: they acknowledge but three sacraments, *viz.* baptism, orders, and the eucharist: they make no use of holy oils in the administration of baptism; but, after the ceremony, anoint the infant with an unction composed of oil and walnuts, without any benediction. In the eucharist, they consecrate with little cakes made of oil and salt, and instead of wine make use of water in which raisins have been infused.

CHRISTIANA, a town of Norway, in the province of Aggerhuys, situated on a bay of the sea. E. Long. 10. 15. N. Lat. 59. 30.

CHRISTIANOPLE, a port-town of Sweden, situated on the Baltic Sea, in the territory of Blecking, and province of South Gothland. E. Long. 15. 40 N. Lat. 57°.

CHRISTIANSTADT, a strong fortified town of Sweden; situated in the territory of Blecking and province of South Gothland. It was built in 1614 by Christian IV. king of Denmark, when this province belonged to the Danes; and finally ceded to the Swedes by the peace of Roskild in 1658. The town is small but neatly built, and is esteemed the strongest fortress in Sweden. The houses are all of brick, and mostly stuccoed white. It stands in a marshy plain close to the river Helge-a, which flows into the Baltic at Ahus about the distance of 20 miles, and is navigable only for small craft of seven tons burden. English vessels annually resort to this port for alum, pitch, and tar. The inhabitants have manufactures of cloth and silken stuffs, and carry an a small degree of commerce. E. Long. 14. 40. N Lat. 56. 30.

CHRISTINA, daughter of Gustavus Adolphus king of Sweden, born in in 1626; and succeeded to the crown in 1633, when only seven years of age. This princess discovered even in her infancy, what she afterwards expressed in her memoirs, an invincible antipathy for the employments and conversation of women; and she had the natural aukwardness of a man with respect to all the little works which generally fall to their share. She was on the contrary, fond of violent exercises, and such amusements as consist in feats of strength and activity. She had also both ability and taste for abstracted speculations; and amused herself with language and the sciences, particularly that of legislature and government. She derived her knowledge of ancient history from its source: and Polybius and Thucydides were her favourite authors. As she was the sovereign of a powerful kingdom, it is not strange that almost all the princes in Europe aspired to her bed. Among others, were the Prince of Denmark, the Elector Palatine, the Elector of Brandenburg, the King of Spain, the king of the Romans, Don John of Austria; Sigismund of Rockocci, count and general of Cassovia; Stanislaus king of Poland; John Cassimir his brother; and Charles Gustavus duke of Deux Ponts, of the Bavarian Palatinate family, son of her father the great Gustavus's sister, and consequently her first cousin. To this nobleman, as well as to all his competitors, she constantly refused her hand; but she caused him to be appointed her successor by the states. Political interests, differences of religion, and contrariety of manners, furnished Christina with pretences for rejecting all her suitors; but her true motives were the love of independence, and a strong aversion she had conceived, even in her infancy, from the marriage yoke. "Do not force me to marry (said she to the states); for if I should have a son, it is not more probable that he should be an Augustus than a Nero."

An accident happened in the beginning of her reign which gave her a remarkable opportunity of displaying the strength and equanimity of her mind. As she was at the chapel of the castle of Stockholm, assisting at divine service with the principal lords of her court, a poor wretch, who was disordered in his mind, came to the place with a design to assassinate her. This man, who was preceptor of the college, and in the full vigour of his age, chose, for the execution of his design, the moment in which the assembly was performing what in the Swedish church is called an *act of recollection*; a silent and separate act of devotion, performed by each individual kneeling and hiding the face with the hand. Taking this opportunity; he rushed through the crowd, and mounted a ballustrade within which the queen was upon her knees. The Baron Braki, chief justice of Sweden, was alarmed, and cried out; and the guards crossed their partisans, to prevent his coming further: but he struck them furiously on one side; leaped over the barrier; and, being then close to the queen, made a blow at her with a knife which he had concealed without a sheath in his sleeve. The queen avoided the blow, and pushed the captain of her guards, who instantly threw himself upon the assassin, and seized him by the hair. All this happened in less than a moment of time. The man was known to be mad, and therefore nobody supposed he had any accomplices: they therefore contented themselves with locking him up; and the queen returned to her devotion without the least emotion that could be perceived by the people, who were much more frightened than herself.

One of the great affairs that employed Christina while she was upon the throne, was the peace of Westphalia, in which many clashing interests were to be reconciled, and many claims to be ascertained. It was concluded in the month of October 1648. The success of the Swedish arms rendered Christina the arbitress of this treaty; at least as to the affairs of Sweden, to which this peace confirmed the possession of many important countries. No public event of importance took place during the rest of Christina's reign; for there were neither wars abroad, nor troubles at home. This quiet might be the effect of chance; but it might also be the effect of a good administration, Christina. ministration, and the great reputation of the queen; and the love her people had for her ought to lead us to this determination. Her reign was that of learning and genius. She drew about her, wherever she was, all the distinguished characters of her time: Grotius, Pascal, Bochart, Descartes, Gassendi, Saumaise, Naude, Vossius, Heinsius, Meibom, Scudery, Menage, Lucas, Holstenius, Lambecius, Bayle, madam Dacier, Filicaia, and many others. The arts never fail to immortalize the prince who protects them; and almost all these illustrious persons have celebrated Christina, either in poems, letters, or literary productions of some other kind, the greater part of which are now forgotten. They form, however, a general cry of praise, and a mass of testimonials which may be considered as a solid basis of reputation. Christina, however, may be justly reproached with want of taste, in not properly assigning the rank of all these persons, whose merits, though acknowledged, were yet unequal; particularly for not having been sufficiently sensible of the superiority of Descartes, whom she disgusted, and at last wholly neglected. The rapid fortune which the adventurer Michon, known by the name of *Bourdelot*, acquired by her countenance and liberality, was also a great scandal to literature. He had no pretensions to learning; and though sprightly, was yet indecent. He was brought to court by the learned Saumaise; and, for a time drove literary merit entirely out of it, making learning the object of his ridicule, and exacting from Christina an exorbitant tribute to the weakness and inconstancy of her sex; for even Christina, with respect to this man, showed herself to be weak and inconstant. At last she was compelled, by the public indignation, to banish this unworthy minion; and he was no sooner gone, than her regard for him was at an end. She was ashamed of the favour she had shown him; and in a short time, thought of him with hatred or contempt. This Bourdelot, during his ascendency over the queen, had supplanted count Magnus de la Gardie, son of the constable of Sweden, who was a relation, a favourite, and perhaps the lover of Christina. M. de Motteville, who had seen him ambassador in France, says, in his memoirs, that he spoke of his queen in terms so passionate and respectful, that every one concluded his attachment to her to be more ardent and tender, than a mere sense of duty can produce. This nobleman fell into disgrace because he showed an inclination to govern; while M. Bourdelot seemed to aim at nothing more than to amuse; and concealed, under the unsuspected character of a droll, the real ascendency which he exercised over the queen's mind.

About this time, an accident happened to Christina which brought her into still greater danger, than that which has been related already. Having given orders for some ships of war to be built at the port of Stockholm, she went to see them when they were finished; and as she was going on board of them, cross a narrow plank, with admiral Fleming, his foot slipping, he fell, and drew the queen with him into the sea, which in that place was near 90 feet deep. Anthony Steinberg, the queen's first equerry, instantly threw himself into the water, laid hold of her robe, and, with such assistance as was given him, got the queen ashore: during this accident, her recollection was such, that the moment her lips were above water, she cried, out, "Take care of the Admiral." When she was got out of the water, she discovered no emotion either by her gesture or countenance; and she dined the same day in public, where she gave a humorous account of her adventure. Christina.

But, though at first she was fond of the power and splendor of royalty, yet she began at length to feel that it embarrassed her; and the same love of independence and liberty which had determined her against marriage, at last made her weary of her crown. As, after her first disgust, it grew more and more irksome to her, she resolved to abdicate; and, in 1652, communicated her resolution to the senate. The senate zealously remonstated against it; and was joined by the people; and even by Charles Gustavus himself, who was to succeed her: she yielded to their importunities, and continued to sacrifice her own pleasure to the will of the public till the year 1654, and then she carried her design into execution. It appears by one of her letters to to M. Canut, in whom she put great confidence, that she had meditated this project for more than eight years; and that she had communicated it to him five years before it took place.

The ceremony of her abdication was a mournful solemnity, a mixture of pomp and sadness, in which scarce any eyes but her own were dry. She continued firm and composed through the whole; and, as soon as it was over, prepared to remove into a country more favourable to science than Sweden was. Concerning the merit of this action, the world has always been divided in opinion; it has been condemned alike both by the ignorant and the learned, the trifler and the sage. It was admired, however, by the great Condé: "How great was the magnanimity of this princess (said he), who could so easily give up that for which the rest of mankind are continually destroying each other, and which so many throughout their whole lives, pursue without attaining!" It appears by the works of St Evermond, that the abdication of Christina was at that time the universal topic of speculation and debate in France. Christina, besides abdicating her crown, abjured her religion: but this act was universally approved by one party and censured by another; the Papists triumphed, and the Protestants were offended. No prince, after a long imprisonment, ever showed so much joy upon being restored to his kingdom, as Christina did in quitting hers. When she came to a little brook, which separates Sweden from Denmark, she got out of her carriage; and leaping to the other side, cried out in a transport of joy, "At last I am free, and out of Sweden, whither I hope I shall never return." She dismissed her women, and laid by the habit of her sex: "I would become a man (said she); yet I do not love men because they are men, but because they are not women." She made her abjuration at Brussels; where she saw the great Condé, who, after his defection, made that city his asylum. "Cousin (said she), who would have thought ten years ago, that we should have met at this distance from our countries?"

The inconstancy of Christina's temper appeared in her going continually from place to place: from Brussels

sels she went to Rome; from Rome to France, and from France she returned to Rome again; after this she went to Sweden, where she was not very well received; from Sweden she went to Hamburgh, where she continued a year, and then went again to Rome; from Rome she returned to Hamburgh; and again to Sweden, where she was still worse received than before; upon which she went back to Hamburgh, and from Hamburgh again to Rome. She intended another journey to Sweden; but it did not take place, any more than an expedition to England, where Cromwell did not seem well disposed to receive her; and after many wanderings, and many purposes of wandering still more, she at last died at Rome in 1689.

It must be acknowledged, that her journeys to Sweden had a motive of necessity; for her appointments were very ill paid, though the states often confirmed them after her abdication: but to other places she was led merely by a roving disposition; and, what is more to her discredit, she always disturbed the quiet of every place she came into, by exacting greater deference to her rank as queen than she had a right to expect, by her total non-conformity to the customs of the place, and by continually exciting and fomenting intrigues of state. She was indeed always too busy, even when she was upon the throne; for there was no event in Europe in which she was not ambitious of acting a principal part. During the troubles in France by the faction called the *Fronde*, she wrote with great eagerness to all the interested parties, officiously offering her mediation to reconcile their interests, and calm their passions, the secret springs of which it was impossible she should know. This was first thought a dangerous, and afterwards a ridiculous, behaviour. During her residence in France she gave universal disgust, not only by violating all the customs of the country, but by practising others directly opposite. She treated the ladies of the court with the greatest rudeness and contempt: when they came to embrace her, she, being in man's habit, cried out, "What a strange eagerness have these women to kiss me! is it because I look like a man?"

But though she ridiculed the manners of the French court, she was very solicitous to enter into its intrigues. Louis XIV. then very young, was enamoured of Mademoiselle de Mancini niece to Cardinal Mazarine; Christina flattered their passion, and offered her service. "I would fain be your confident (said she); if you love, you must marry."

The murder of Monaldeschi is, to this hour, an inscrutable mystery. It is, however, of a piece with the expressions constantly used by Christina in her letters, with respect to those with whom she was offended; for she scarce ever signified her displeasure without threatening the life of the offender. "If you fail in your duty, (said she to her secretary, whom she sent to Stockholm after her abdication), not all the power of the king of Sweden shall save your life, though you should take shelter in his arms." A musician having quitted her service for that of the duke of Savoy, she was so transported with rage as to disgrace herself by these words, in a letter written with her own hand: "He lives only for me; and if he does not sing for me, he shall not long sing for any body."



Bayle was also threatened for having said that the letter which Christina wrote, upon the revocation of the edict of Nantes, was "a remain of Protestantism;" but he made his peace by apologies and submission. See the article BAYLE.

Upon the whole, she appears to have been an uncommon mixture of faults and great qualities; which, however it might excite fear and respect, was by no means amiable. She had wit, taste, parts, and learning: she was indefatigable upon the throne; great in private life; firm in misfortunes; impatient of contradiction; and, except in her love of letters, inconstant in her inclinations. The most remarkable instance of this fickleness is, That after she had abdicated the crown of Sweden, she intrigued for that of Poland. She was, in every action and pursuit, violent and ardent in the highest degree; impetuous in her desires, dreadful in her resentment, and fickle in her conduct.

She says of herself, "that she was mistrustful, ambitious, passionate, haughty, impatient, contemptuous, satyrical, incredulous, undevout, of an ardent and violent temper, and extremely amorous;" a disposition, however, to which, if she may be believed, her pride and her virtue were always superior. In general, her failings were those of her sex, and her virtues the virtues of ours.

*Santa-CHRISTINA*, one of the MARQUESAS *Islands*.

CHRISTMAS-DAY, a festival of the Christian church; observed on the 25th of December, in memory of the *nativity* or birth of Jesus Christ. As to the antiquity of this festival, the first footsteps we find of it are in the second century, about the time of the emperor Commodus. The decretal epistles indeed carry it up a little higher; and say that Telesphorus, who lived in the reign of Antoninus Pius, ordered divine service to be celebrated, and an angelical hymn to be sung, the night before the nativity of our Saviour. However, that it was kept before the times of Constantine we have a melancholy proof: for whilst the persecution raged under Dioclesian, who then kept his court at Nicomedia, that prince, among other acts of cruelty, finding multitudes of Christians assembled together to celebrate Christ's nativity, commanded the church-doors where they were met to be shut, and fire to be put to it, which, in a short time, reduced them and it to ashes.

CHRISTOPHER'S, St. one of the Caribbee Islands, in America, lying to the north-west of Nevis, and about 60 miles west of Antigua. It was formerly inhabited by the French and English; but, in 1713, it was ceded entirely to the latter. In 1782, it was taken by the French, but restored to Britain at the peace. It is about 20 miles in breadth and seven in length; and has high mountains in the middle, whence rivulets run down. Between the mountains are dreadful rocks, horrid precipices, and thick woods; and in the south-west part of the island, hot sulphureous springs at the foot of them. The air is good; the soil, light, sandy, and fruitful; but the island is subject to hurricanes. The produce is chiefly sugar, cotton, ginger, indigo, and the tropical fruits. W. Long. 62. 32. N. Lat. 17. 30.

CHROASTACES, in natural history, a genus of pellucid gems, comprehending all those of variable colours, as viewed in different lights; of which kinds

Chromatic. are the *opal* and the *asteria* or *oculus cati*. See Opal and Asteria.

CHROMATIC, a kind of music which proceeds by several semitones in succession. The word is derived from the Greek χρωμα, which signifies *colour*. For this denomination several causes are assigned, of which none appear certain, and all equally unsatisfactory. Instead, therefore, of fixing upon any, we shall offer a conjecture of our own; which, however, we do not impose upon the reader as more worthy of his attention than any of the former. Χρωμα may perhaps not only signify a *colour*, but that shade of a colour by which it melts into another, or what the French call *nuance*. If this interpretation be admitted, it will be highly applicable to semitones; which being the smallest interval allowed in the diatonic scale, will most easily run one into another. To find the reasons assigned by the ancients for this denomination, and their various divisions of the chromatic species, the reader may have recourse to the same article in Rousseau's Musical Dictionary. At present, that species consists in giving such a procedure to the fundamental bass, that the parts in the harmony, or at least some of them may proceed by semitones, as well in rising as descending; which is most frequently found in the minor mode, from the alterations to which the sixth and seventh note are subjected, by the nature of the mode itself.

The successive semitones used in the *chromatic* species are rarely of the same kind; but alternately major and minor, that is to say, *chromatic* and *diatonic:* for the interval of a minor tone contains a major or chromatic semitone, and another which is major or diatonic; a measure which temperament renders common to all tones: so that we cannot proceed by two minor semitones which are conjunctive in succession, without entering into the enharmonic species; but two major semitones twice follow each other in the *chromatic* order of the scale.

Chromatic. The most certain procedure of the fundamental bass to generate the chromatic elements in ascent, is alternately to descend by thirds, and rise by fourths, whilst all the chords carry the third major. If the fundamental bass proceeds from dominant to dominant by perfect cadences avoided, it produces the *chromatic* in descending. To produce both at once, you interweave the perfect and broken cadences, but at the same time avoid them.

As at every note in the *chromatic* species one must change the tone, that succession ought to be regulated and limited for fear of deviation. For this purpose, it will be proper to recollect, that the space most suitable to *chromatic* movements, is between the extremes of the dominant and the tonic in ascending, and between the tonic and the dominant in descending. In the major mode, one may also chromatically descend from the dominant upon the second note. This transition is very common in Italy; and, notwithstanding its beauty, begins to be a little too common amongst us.

The chromatic species is admirably fitted to express grief and affliction: these sounds boldly struck in ascending tear the soul. Their power is no less magical in descending; it is then that the ear seems to be pierced with real groans. Attended with its proper harmony, this species appears proper to express every thing: but its completion, by concealing the melody, sacrifices a part of its expression; and for this disadvantage, arising from the fullness of the harmony, it can only be compensated by the nature and genius of the movement. We may add, that in proportion to the energy of this species, the composer ought to use it with greater caution and parsimony. Like those delicate viands, which when profusely administered, immediately surfeit us with their abundance: as much as they delight us when enjoyed with temperance, so much do they disgust when devoured with prodigality.

Chromatic, *Enharmonic*. See Enharmonic.

# CHROMATICS;

That part of optics which explains the several properties of the colours of light, and of natural bodies.

1 Different hypotheses concerning colours.

Before the time of Sir Isaac Newton, we find no hypothesis concerning colours of any consequence. The opinions of the old philosophers, however, we shall briefly mention, in order to gratify the curiosity of our readers. The Pythagoreans called colour the superficies of body. Plato said that it was a flame issuing from them. According to Zeno, it is the first configuration of matter; and Aristotle said it was that which moved bodies actually transparent. Descartes asserted, that colour is a modification of light; but he imagined, that the difference of colour proceeds from the prevalence of the direct or rotatory motion of the particles of light. Father Grimaldi, Dechales, and many others, thought the differences of colour depended upon the quick or slow vibrations of a certain elastic medium filling the whole universe. Rohault imagined, that the different colours were made by the rays of light entering the eye at different angles with respect to the optic axis; and from the phænomenon of the rainbow, he pretended to calculate the precise quantity of the angle that constituted each particular colour. Lastly, Dr Hooke, the rival of Newton, imagined that colour is caused by the sensation of the oblique or uneven pulse of light; and this being capable of no more than two varieties, he concluded there could be no more than two primary colours.

2 This subject investigated by Sir Isaac Newton.

In the year 1666, Sir Isaac Newton began to investigate this subject; and finding the coloured image of the sun, formed by a glass prism, to be of an oblong, and not of a circular form, as, according to the laws of refraction, it ought to be, he began to conjecture that light is not *homogeneal;* but that it consists of rays, some of which are much more refrangible than others. See this discovery fully explained and ascertained under the article Optics.

This method of accounting for the different colours of bodies, from their reflecting this or that kind of rays most copiously, is so easy and natural, that Sir Isaac's system quickly overcame all objections, and to this

this day continues to be almost universally believed. It is now acknowledged, that the light of the sun, which to us seems perfectly homogeneal and white, is composed of no fewer than seven different colours, *viz.* red, orange, yellow, green, blue, purple, and violet or indigo. A body which appears of a red colour, hath the property of reflecting the red rays more powerfully than any of the others; and so of the orange, yellow, green, &c. A body which is of a black colour, instead of reflecting, *absorbs* all or the greatest part of the rays that fall upon it; and, on the contrary, a body which appears white, reflects the greatest part of the rays indiscriminately, without separating the one from the other.

The foundation of a rational theory of colours being thus laid, it next became natural to inquire, by what peculiar mechanism in the structure of each particular body it was fitted to reflect one kind of rays more than another? This Sir Isaac Newton attributes to the density of these bodies. Dr Hooke had remarked, that thin transparent substances, particularly water and soap blown into bubbles, exhibited various colours according to their thinness, though, when they have a considerable degree of thickness, they appear colourless; and Sir Isaac himself had observed, that as he was compressing two prisms hard together, in order to make their sides (which happened to be a little convex) to touch one another, in the place of contact they were both perfectly transparent, as if they had been but one continued piece of glass. Round the point of contact, where the glasses were a little separate from each other, rings of different colours appeared. To observe more nicely the order of the colours produced in this manner, he took two object-glasses; one of them a plano-convex one belonging to a 14 feet refracting telescope, and the other a large double convex one for a telescope of about 50 feet; and laying the former of them upon the latter, with its plain side downwards, he pressed them slowly together; by which means the colours very soon emerged, and appeared distinct to a considerable distance. Next to the pellucid central spot, made by the contact of the glasses, succeeded blue, white, yellow, and red. The blue was very little in quantity, nor could he discern any violet in it; but the yellow and red were very copious, extending about as far as the white, and four or five times as far as the blue. The next circuit immediately surrounding these, consisted of violet, blue, green, yellow, and red: all these were copious and vivid, except the green, which was very little in quantity, and seemed more faint and dilute than the other colours. Of the other four, the violet was the least in extent; and the blue less than the yellow or red. The third circle of colours was purple, blue, green, yellow, and red. In this the purple seemed more reddish than the violet in the former circuit and the green was more conspicuous; being as brisk and copious as any of the other colours, except the yellow; but the red began to be a little faded, inclining much to purple. The fourth circle consisted of green and red; and of these the green was very copious and lively, inclining on the one side to blue, and on the other to yellow; but in this fourth circle there was neither violet, blue, nor yellow, and the red was very imperfect and dirty.

3 Colours appearing between two glass plates.

All the succeeding colours grew more and more imperfect and dilute, till after three or four revolutions they ended in perfect whiteness.

As the colours were thus found to vary according to the different distances of the glass-plates from each other, our author thought that they proceeded from the different thickness of the plate of air intercepted between the glasses; this plate of air being, by the mere circumstance of thinness or thickness, disposed to reflect or transmit this or that particular colour. From this he concluded, as already observed, that the colours of all natural bodies depended on their density, or the bigness of their component particles. He also constructed a table, wherein the thickness of a plate necessary to reflect any particular colour was expressed in parts of an inch divided into 1,000,000 parts.

4 Supposed to arise from density.

5 Colours by reflection.

Sir Isaac Newton pursuing his discoveries concerning the colours of thin substances, found that the same were also produced by plates of a considerable thickness. There is no glass or speculum, he observes, how well polished soever, but, besides the light which it refracts or reflects regularly, scatters every way irregularly a faint light; by means of which the polished surface, when illuminated in a dark room by a beam of the sun's light, may easily be seen in all positions of the eye. It was with this scattered light that the colours in the following experiments were produced.

The sun shining into his darkened chamber through a hole in the shutter one inch wide, he let the beam of light fall perpendicularly upon a glass speculum, concave on one side and convex on the other, ground to a sphere of five feet eleven inches radius, and quicksilvered over on the convex side. Then, holding a quire of white paper at the centre of the sphere, to which the speculums were ground, in such a manner as that the beam of light might pass through a little hole made in the middle of the paper, to the speculum, and thence be reflected back to the same hole, he observed on the paper four or five concentric rings of colours, like rainbows surrounding the hole, very much like those which appeared in the thin plates abovementioned, but larger and fainter. These rings, as they grew larger and larger, became more dilute, so that the fifth was hardly visible; and yet sometimes, when the sun shone very clear, there appeared faint traces of a sixth and seventh.

6 Colours by refraction and reflection enumerated.

We have already taken notice, that the thin plates made use of in the former experiments reflected some kinds of rays in particular parts, and transmitted others in the same parts. Hence the coloured rings appeared variously disposed, according as they were viewed by transmitted or reflected light; that is, according as the plates were held up between the light and the eye, or not. For the better understanding of which we subjoin the following table, wherein on one side are mentioned the colours appearing on the plates by reflected light, and on the other those which were opposite to them, and which became visible when the glasses were held up between the eye and the window. We have already observed, that the centre, when the glasses were in full contact, was perfectly transparent. This spot, therefore, when viewed by reflected light, appeared

appeared black, becauſe it tranſmitted all the rays: and for the ſame reaſon it appeared white when viewed by tranſmitted light.

| *Colours by reflected Light.* | *Colours by Tranſmitted Light.* |
|---|---|
| Black | White |
| Blue | Yellowiſh-red |
| White | Black |
| Yellow | Violet |
| Red | Blue |
| Violet | White |
| Blue | Yellow |
| Green | Red |
| Yellow | Violet |
| Red | Blue |
| Purple | Green |
| Blue | Yellow |
| Green | Red |
| Yellow } Red } | Bluiſh-green |
| Green | Red |
| Red | Bluiſh-green |
| Greeniſh-blue | Red. |
| Red. | |

The colours of the rings produced from reflection by the thick plates, followed the order of thoſe produced by tranſmiſſion through the thin ones: and by the analogy of their phenomena with thoſe produced from the thin plates, Sir Iſaac Newton concluded that they were produced in a ſimilar manner. For he found, that if the quickſilver was rubbed off from the back of the ſpeculum, the glaſs alone would produce the ſame rings, but much more faint than before; ſo that the phenomenon did not depend upon the quickſilver, except in as far as, by increaſing the reflection at the back of the glaſs, it increaſed the light of the coloured rings. He alſo found that a ſpeculum of metal only, produced none of thoſe rings; which made him conclude, that they did not ariſe from one ſurface only, but depended on the two ſurfaces of the plate of glaſs of which the ſpeculum was made, and upon the thickneſs of the glaſs between them.

7 General theory of colours by Sir Iſaac Newton.

From theſe experiments and obſervations, it will be eaſy to underſtand the Newtonian theory of colours. Every ſubſtance in nature ſeems to be tranſparent, provided it is made ſufficiently thin. Gold, the moſt denſe ſubſtance we know, when reduced into thin leaves, tranſmits a bluiſh-green light through it. If, therefore, we ſuppoſe any body, gold, for inſtance, to be divided into a vaſt number of plates ſo thin as to be almoſt perfectly tranſparent, it is evident that all or greateſt part of the rays will paſs through the upper plates, and when they loſe their force will be reflected from the under ones. They will then have the ſame number of plates to paſs through which they had penetrated before; and thus, according to the number of thoſe plates through which they are obliged to paſs, the object appears of this or that colour, juſt as the rings of colours appeared different in the experiment of the two plates, according to their diſtance from one another, or the thickneſs of the plate of air between them.

This theory is adopted by Edward Huſſey Delaval, in his Experimental Inquiry into the cauſe of the changes of colours in opaque and coloured bodies.

8 Mr Delaval's experiments in confirmation of it.

He endeavours to confirm it by a number of experiments on the infuſions of flowers of different colours; but his ſtrongeſt arguments ſeem to be thoſe derived from the different tinges given to glaſs by metallic ſubſtances. Here he obſerves, that each metal gives a tinge according to its ſpecific denſity; the more denſe metals producing the leſs refrangible colours, and the lighter ones thoſe colours which are more eaſily refrangible. Gold, which is the denſeſt of all metals, imparts a red colour to glaſs, whenever it can be divided into particles ſo minute, that it is capable of being mixed with the materials of which glaſs is made. It ſeems indifferent by what means it is reduced to this ſtate, nor can it by any means be made to produce another colour. If it is mixed in large maſſes without being minutely divided, it imparts no colour to the glaſs, but remains in its metallic form. Lead, the metal whoſe denſity is next in order to that of gold, affords a glaſs of the colour of the hyacinth; a gem whoſe diſtinguiſhing characteriſtic is, that it is red with an admixture of yellow, the ſame colour which is uſually called *orange*. Glaſs of lead is mentioned by ſeveral authors as a compoſition proper, without the addition of any other ingredient, for imitating the hyacinth. Silver, next in denſity to lead, can only be made to communicate a yellow colour to glaſs. If the metal is calcined with ſulphur, it readily communicates this colour. Leaf-ſilver laid upon red-hot glaſs likewiſe tinges it yellow. When we meet with authors who mention a blue or greeniſh colour communicated by ſilver, the cauſe, muſt have been, that the ſilver uſed in ſuch proceſſes was mixed with copper. Mr Delaval aſſures us, from his own experience, that ſilver purified by the teſt retains ſo much copper, that, when melted ſeveral times with nitre and borax, it always imparted a green colour at the firſt and ſecond melting; though afterwards no ſuch colour was obtainable from it. The only colour produced by copper is green. It is indifferent in what manner the copper is prepared in order to tinge the glaſs, provided it is expoſed without any other ingredient to a ſufficient degree of heat. If a quantity of ſalts are added in the preparation, they will, by attenuating the mixture, make the glaſs incline to blue, the colour next in order: but this happens only when the fire is moderate; for, in a greater degree of heat, the redundant ſalts, even thoſe of the moſt fixed nature, are expelled. It is true, that copper is mentioned by ſome writers as an ingredient in red glaſs and enamel: but the *red*, which is the colour of the metal not diſſolved or mixed with the glaſs, remains only while the compoſition is expoſed to ſuch a degree of heat as is too ſmall to melt and incorporate it; for, if it be ſuffered to remain in the furnace a few minutes after the copper is added, the maſs will turn out green inſtead of red. Iron, the metal next in denſity to copper, is apt to be calcined, or reduced to a ruddy crocus, ſimilar to that ruſt which it contracts ſpontaneouſly in the air. In this ſtate, it requires a conſiderable degree of heat to diſſolve and incorporate it with glaſs: till that heat is applied, it retains its ruddy colour: by increaſing the heat, it paſſes through the intermediate colours, till it arrives at its permanent one, which is blue; this being effected in the greateſt degree of heat the glass will bear, without losing all colour whatever. Iron vitrified *per se* is converted into a blue glass. In short, it is indubitable, that iron is the only metal which will, without any addition, impart to the glass a blue colour: for copper will not communicate that colour without the addition of a considerable quantity of salts; or some other matter that attenuates it; and the other metals cannot by any means be made to produce it at all.

9 Sir Isaac's theory defended by Dr Priestley.

These are the principal of Mr Delaval's arguments in favour of Sir Isaac Newton's theory of colours being formed by density. Dr Priestley too hath mentioned some which deserve attention. "It was a discovery of Sir Isaac Newton (says he), that the colours of bodies depend upon the thickness of the fine plates which compose their surfaces. He hath shown, that a change of the thickness of these plates occasions a change in the colours of the body; rays of a different colour being thereby disposed to be transmitted through it; and consequently rays of a different colour reflected at the same place, so as to present an image of a different colour to the eye. A variation in the density occasions a variation in the colour; but still a medium of any density will exhibit all the colours, according to the thickness of it. These observations he confirmed by experiments on plates of air, water, and glass. He likewise mentions the colours which arise on polished steel by heating it, as likewise on bell-metal, and some other metalline substances, when melted and poured on the ground, where they may cool in the open air; and he ascribes them to the scoriae or vitrified parts of the metal, which, he says, most metals, when heated or melted, do continually protrude and send out to their surfaces, covering them in the form of a thin glassy skin. This great discovery concerning the colours of bodies depending on the thickness of the fine plates which compose their surfaces, of whatever density these plates may be, I have been so happy as to hit upon a method of illustrating and confirming by means of electrical explosions.

10 His experiments.

A number of these being received on the surface of any piece of metal, change the colour of it to a considerable distance from the spot on which they were discharged; so that the whole circular space is divided into a number of concentric rings, each of which consists of all the prismatic colours, and perhaps as vivid as they can be produced in any method whatever.

11 Mr Canton's experiments.

Upon showing these coloured rings to Mr Canton, I was agreeably surprised to find, that he had likewise produced all the prismatic colours from all the metals, but by a different operation. He extended fine wires of all the different metals along the surfaces of pieces of glass, ivory, wood, &c.; and when the wire was exploded, he always found them tinged with all the colours. They are not disposed in so regular and beautiful a manner as in the rings I produced, but they equally demonstrate that none of the metals thus exploded discovers the least preference to one colour more than to another. In what manner these colours are formed it may not be easy to conjecture. In Mr Canton's method of producing them, the metal, or the calcined and vitrified parts of it, seem to be dispersed, in all directions from the plate of explosion, in the form of spheres of a very great variety of sizes, tinged with all the variety of colours, and some of them smaller than can be distinctly seen by any magnifier. In my method of making these colours, they seem to be produced in a manner similar to the production of colours on steel and other metals by heat; *i. e.* the surface is affected without the parts of it being removed from their places, certain plates or laminae being formed of a thickness proper to exhibit the respective colours."

12 Newtonian theory impugned by Dr Priestley.

But, however well supported this doctrine of the formation of colours by density may be, we find the same author (Dr Priestley), whom we have just now seen arguing for it in his history of electricity, arguing against it in his history of vision. "There are (says he) no optical experiments with which Sir Isaac Newton seems to have taken more pains than those relating to the rings of colours which appear in thin plates; and in all his observations and investigations concerning them, he discovers the greatest sagacity both as a philosopher and mathematician; and yet in no subject to which he gave his attention, does he seem to have overlooked more important circumstances in the appearances he observed, or to have been more mistaken with regard to their causes. The former will be evident from the observations of those who succeeded him in these inquiries, particularly those of the Abbe Mazeas.

13 Curious experiments by the Abbe Mazeas.

This gentleman, endeavouring to give a very high polish to the flat side of an object-glass, happened to be rubbing it against another piece of flat and smooth glass; when he was surprised to find, that after this friction, they adhered very firmly together, till at last he could not move the one upon the other. But he was much more surprised to observe the same colours between these plane glasses that Newton observed between the convex object-glass of a telescope and another that was plane. These colours between the plane glasses, the Abbe observes, were in proportion to their adhesion. The resemblance between them and the colours produced by Newton, induced him to give a very particular attention to them; and his observations and experiments are as follow:

"If the surfaces of the pieces of glass are transparent, and well polished, such as are used for mirrors, and the pressure be as equal as possible on every part of the two surfaces, a resistance, he says, will soon be perceived when one of them is made to slide over the other; sometimes towards the middle, and sometimes towards the edges; but wherever the resistance is felt, two or three very fine curve lines will be perceived, some of a pale red, and others of a faint green. Continuing the friction, these red and green lines increase in number at the place of contact, the colours being sometimes mixed without any order, and sometimes disposed in a regular manner. In the last case, the coloured lines are generally concentric circles, or ellipses, or rather ovals, more or less elongated as the surfaces are more or less united. These figures will not fail to appear, if the glasses are well wiped and warmed before the friction.

"When the colours are formed, the glasses adhere with considerable force, and would always continue so without any change in the colours. In the centre of all those ovals, the longer diameter of which generally exceeds ten lines, there appears a small plate of the same figure, exactly like a plate of gold interposed between the glasses; and in the centre of it there is often

often a dark spot, which absorbs all the rays of light except the violet; for this colour appears very vivid through a prism.

"If the glasses are separated suddenly, either by sliding them horizontally over one another, or by the action of fire, as will be explained hereafter, the colours will appear immediately upon their being put together again, without the least friction.

"Beginning by the slightest touch, and increasing the pressure by insensible degrees, there first appears an oval plate of a faint red, and in the midst of it a spot of light green, which enlarges by the pressure, and becomes a green oval, with a red spot in the centre; and this, enlarging in its turn, discovers a green spot in its centre. Thus the red and the green succeed one another in turns, assuming different shades, and having other colours mixed with them, which will be distinguished presently.

"The greatest difference between these colours exhibited between plane surfaces and those formed by curve ones is, that in the former case pressure alone will not produce them, except in the case abovementioned. With whatever force he compressed them, his attempts to produce the colours were in vain without previous friction. But the reason of this plainly was, that without sliding one of the glasses over the other, they could not be brought to approach near enough for the purpose.

"Having made these observations with plates of glass whose sides were nearly parallel, he got two prisms with very small refracting angles; and rubbing them together, when they were so joined as to form a parallelopiped, the colours appeared with a surprising lustre at the places of contact, owing, he did not doubt, to the separation of the rays of light by the prism. In this case, differently coloured ovals appeared, but the plate of gold in them was much whiter, and only appeared yellow about its edges. This plate having a black spot in its centre, was bordered by a deep purple. He could not perceive any violet by his naked eye, but it might be perceived by the help of a lens with a weak light. It appeared in a very small quantity at the confines of the purple and the blue, and seemed to him to be only a mixture of these two colours. It was very visible in each of the coloured rings by inclining the glasses to the light of the moon. Next to the purple and violet appeared blue, orange, red tinged with purple, light green, and faint purple. The other rings appeared to the naked eye to consist of nothing but faint reds and greens; and they were so shaded that it was not easy to mark their terminations. That the order of these may be compared with Newton's, he gives a view of both in the following table:

| | *Order of the Colours in the Plane Glasses.* | *Order of the Colours in Newt. Object Glasses.* |
|---|---|---|
| Order I. | Black spot | Black |
| | Whitish oval | Blue |
| | Yellow border | White |
| | Deep purple | Yellow |
| | | Red |
| Order II. | Blue | Violet. |
| | Orange | Blue |
| | Purple | Green |
| | | Yellow |
| | | Red. |
| Order III. | Greenish blue | Purple |
| | Yellowish green | Blue |
| | Purpled red | Green |
| | | Yellow |
| | | Red |
| Order IV. | Green | Green |
| | Red | Red |
| Order V. | Faint green | Greenish blue |
| | Faint red | Red |
| Order VI. | Weak green | Greenish blue |
| | Light red | Red |
| Order VII | Very faint green | Greenish blue |
| | Very faint red. | Pale red. |

"When these coloured glasses were suspended over the flame of a candle, the colours disappeared suddenly, though the glasses still continued to adhere to one another when they were parallel to the horizon. When they were suffered to cool, the colours returned by degrees to their former places, in the order of the preceding table.

"After this the Abbe took two plates much thicker than the former, in order to observe at his leisure the action of fire upon the matter which he supposed to produce the colours and observed, that as they grew warm, the colours retired to the edges of the glasses, and there became narrower and narrower till they were reduced to imperceptible lines. Withdrawing the flame, they returned to their place. This experiment he continued till the glasses were bent by the violence of the heat. It was pleasant, he says, to observe these colours glide over the surface of the glass as they were pursued by the flame.

"At the first, our author had no doubt but that these colours were owing to a thin plate of air between the glasses, to which Newton has ascribed them; but the remarkable difference in the circumstances attending those produced by the flat plates, and those produced by the object-glasses of Newton, convinced him that the air was not the cause of this appearance. The colours of the flat plates vanished at the approach of flame, but those of the object-glasses did not. He even heated the latter till that which was next the flame was cracked by the heat, before he could observe the least dilatation of the coloured rings. This difference was not owing to the plane glasses being less compressed than the convex ones; for though the former were compressed ever so much by a pair of forceps it did not in the least hinder the effect of the flame.

"Afterwards he put both the plane glasses and the convex ones into the receiver of an air-pump, suspending the former by a thread, and keeping the latter compressed by two strings; but he observed no change in the colours of either of them in the most perfect vacuum he could make.

"Notwithstanding these experiments seemed to be conclusive against the hypothesis of these colours being formed by a plate of air, the Abbe frankly acknowledges, that the air may adhere so obstinately to the surface of the glasses as not to be separated from them by the force of the pump; which, indeed, is agreeable to other appearances: but the following experiments of our author make it still more improbable that the air should be the cause of these colours.



"To

"To try the utmost effect of heat upon these coloured plates, after warming them gradually, he laid them upon burning coals; but though they were nearly red, yet when he rubbed them together by means of an iron rod, he observed the same coloured circles and ovals as before. When he ceased to press upon them, the colours seemed to vanish; but when he repeated the friction, they returned, and continued till the pieces of glass began to be red-hot, and their surfaces to be united by fusion.

"When the outward surface of one of his plates of glass was quicksilvered, none of those colours were visible, though the glasses continued to adhere with the same force. This he ascribed to the stronger impression made on the eye by the greater quantity of light reflected from the quicksilver.

"Judging from the resemblance between his experiments and those of Sir Isaac Newton, that the colours were owing to the thickness of some matter, whatever that was, interposed between the glasses, the Abbe, in order to verify his hypothesis, tried the experiment on thicker substances. He put between his glasses a little ball of suet, about a fourth of a line in diameter, and pressed it between the two surfaces, warming them at the same time, in order to disperse the suet; but, though he rubbed them together as before, and used other soft substances besides suet, his endeavours to produce the colours had no effect. But, rubbing them with more violence in a circular manner, he was surprised, on looking at a candle through them, to see it surrounded with two or three concentric rings, very broad, and with very lively delicate colours; namely, a red inclining to a yellow, and a green inclining to that of an emerald. At that time he observed only these two colours; but continuing the friction, the rings assumed the colours of blue, yellow, and violet, especially when he looked through the glasses on bodies directly opposed to the sun. If, after having rubbed the glasses, the thickness was considerably diminished, the colours grew weaker by transmitted light, but they seemed to be much stronger by reflection, and to gain on one side what they lost on the other.

14 Newtonian hypothesis opposed.

"Our author was confirmed in his opinion, that there must be some error in Newton's hypothesis, by considering, that, according to his measures, the colours of the plates varied with the difference of a millionth part of an inch; whereas he was satisfied that there must have been much greater differences in the distance between his glasses, when the colours remained unchanged.

"If the colour depended upon the thickness only, he thought that the matter interposed between the glasses ought to have given the same colour when it was reduced to a thin plate by simple fusion as well as by friction, and that, in rubbing two plates together, warming them at different times, and compressing them with a considerable force, other colours would have appeared besides those abovementioned.

"These circumstances made him suspect, that the different thicknesses of the substance interposed between the glasses served only to make them more or less transparent, which was an essential condition in the experiment; and he imagined that the friction diffused over the surface of the thin substance a kind of matter on which the colours are formed by reflected light: for when he held the plates (which gave the colours when the suet was between them) over the flame of a small candle, the colours fled with great precipitation, and returned to their place without his being able to perceive the least alteration in the suet.

"He was confirmed in his conjectures, by frequently observing, that when the glasses were separated, at the moment the colours disappeared, they were covered with the same greasy matter, and that it seemed to be in the very same state as when they were separated without warming. Besides, having often repeated the same experiment with different kinds of matter, he found that the degree of heat that dispersed the colours was not always sufficient to melt it; which difference was more sensible in proportion as the matter interposed was made thinner.

"Instead of the suet, he sometimes made use of Spanish wax, resin, common wax, and the sediment of urine. He began with Spanish wax, on account of its remarkable transparency in Mr Hauksbee's electrical experiments; but he had much difficulty in making it sufficiently thin by friction, being often obliged to warm his glasses, to seize the moment of fusion, which continued but a short time, and to hazard the burning of his fingers.

"The experiment at length succeeding, the Spanish wax appeared with its opacity and natural colour when it reflected the light, but they both disappeared in the transmitted light. He observed the same rings in it as in the suet; and indeed he could perceive but little difference between the colours of suet, Spanish wax, common wax, or resin; except that this last substance did not make the colours so vivid, on account of the too great transparency of its particles.

"The sediment of urine had something more particular in its appearance, as its colours were more lively. Holding it above the flame, its colours disappeared; and, keeping it in that situation, there were formed, upon its surface, ramifications, like those of the hoar-frost, which disappeared as the glasses grew cold. There were the same ramifications both upon the suet and the wax, but they were not so considerable. The glasses which had Spanish wax and resin between them adhered with so much force, that they could not be separated without the help of fire; and when they began to grow warm, they separated with a noise like that of a glass breaking in the fire, though the glasses were not broken, and the matter between them was not melted.

"Separating the glasses which he first used very suddenly, he observed upon their surface very thin vapours, which formed different colours, but presently vanished altogether.

"To try the effect of vapour, he breathed upon one of his plates of glass, and observed that the vapours which adhered to the glasses sometimes formed, before they were entirely dispersed, a surprising variety of colours. This experiment, he observes, does not always succeed at the first trial. The glass must be breathed upon several times, and care must be taken to wipe it every time with one's hand, both to take off the moisture, and also to make upon the glass a kind of furrows, which contribute very much to the variety of colours, by making inequalities in the thicknesses of the vapours. It is necessary, also, that the glasses

glasses on which these experiments are made have no quicksilver upon them.

" When the particles of water which formed this vapour were too thick to exhibit their colours, he struck them several times with his pencil, in order to attenuate them; and then he saw an infinity of small coloured threads which succeeded one another with great rapidity.

" Putting a drop of water between two pieces of common glass, he observed that the compression of them produced no colour; but if, while they were compressed, the water was made to pass from one place to another, it left behind it large spots, red, yellow, green, purple, *&c.* and the spots assumed different colours with a surprising rapidity, and presented to the eye a most beautiful variety of shades.

" In order to determine with greater certainty whether they were vapours that caused the colours in his first observations, he first breathed upon one of his plates of glass, and then rubbed them against one another, when the colours appeared in the same order as before, but darker, and dispersed in confusion in the places occupied by the vapours; but when he made use of fire to dissipate the watery particles, the colours resumed their lustre.

" Newton, having introduced a drop of water between his two object-glasses, observed, that in proportion as the water insinuated itself between the glasses, the colours grew fainter, and the rings were contracted; and ascribing these colours to the thickness of the plate of water, as he ascribed the former to that of the plate of air, he measured the diameters of the coloured rings made by the plate of water, and concluded that the intervals between the glasses at the similar rings of these two mediums were nearly as three to four; and thence he inferred, that, in all cases, these intervals would be as the sines of the refractions of these mediums.

" The Abbé Mazeas, in order to assure himself whether, agreeable to this rule, the coloured rings of his glasses depended upon the thickness of the water only, dipped one of the edges of his coloured glasses in a vessel of water, having taken care to wipe and warm them well before he produced his colours by friction. The water was a considerable time in rising as high as the glasses; and in proportion as it ascended, he perceived a very thin plate of water, which seemed to pass over the matter which he thought produced the colours, without mixing with it; for beyond this plate of water, he still perceived the colours in the same place and order, but deeper and darker; and holding the glasses above the flame of a candle, he saw the colours go and come several times as he moved them nearer to or farther from the flame. He then moistened both the glasses more than before; and rubbing them as usual, he always saw the same appearance; and seizing the moment when the colours had disappeared to separate the glasses, he always found that they were wet. On this account, he thought that it could not be the water on which the colour depended, but some substance much more sensible to heat. He also thought that these coloured rings could not be owing to the compression of the glasses; or that, if this circumstance did contribute any thing to them, it served rather to modify than to generate them.

15 M. du Tour's observations.

" M. du Tour gave particular attention to the preceding observations of the Abbé Mazeas. He repeated the experiments with some variation of circumstances, particularly comparing them with those of Sir Isaac Newton. He is so far from supposing a plate of air to be necessary to the formation of these coloured rings, that he thinks the reason of their not appearing between the flat plates of glass is the adhering of the air to their surfaces; and that mere pressure is not sufficient to expel it; except, as the Abbé Mazeas observed, the rings had before been made in the same place; in which case, simple apposition without friction is sufficient; the air, probably, not having had time to apply itself so closely to the surface of the glass. The contact of some other substances, M. du Tour observes, is not so prejudicial in this experiment as that of air; for he found, that, if he only gave the plates a slight coating of any kind of grease, the rings would appear without friction. Also dipping them slightly in water, or wiping them with his finger, would answer the same purpose. He verified his conjectures by means of the air-pump: for, dipping two pieces of glass in water, one of which had been wiped, and the other not, the former appeared to have no bubbles adhering to it when the air was exhausted, whereas the other had.

" When one of the glasses is convex, our author observes, that the particles of air may more easily make their escape by pressure only; whereas their retreat is in a manner cut off when they are compressed between two flat surfaces. The air-pump, he found, was not able to detach these particles of air from the surfaces to which they adhere; leaving these flat plates for a considerable time in an exhausted receiver, was not sufficient to prepare them so well for the experiment, as wiping them.

16 Experiments on colours by reflection.

" Besides the observations on the colours of thin plates, it has been seen that Sir Isaac Newton imagined he could account for the colours exhibited by thick ones in some cases in a similar manner; particularly in those curious experiments in which he admitted a beam of light through a hole in a piece of pasteboard, and observed the rings of colours reflected back upon it by a concave glass mirror of equal thickness in all places. These experiments were resumed, and happily pursued, by the Duke de Chaulnes, who ascribed these colours to the inflection of light*. Chance led the duke to observe, that when the nearer surface of the glass mirror was clouded by breathing upon it, so as lightly to tarnish it, a white diffused and vivid light was seen upon the pasteboard, and all the colours of the rings became much stronger, and more distinct. This appearance he made constant by moistening the surface of the mirror with a little milk and water, and suffering it to dry upon it.

* See *Optics*.

" In all his experiments upon this subject, he found, than when the rays fell converging on the surface of the mirror, the rings were hardly visible; when they fell parallel upon it, as they must have done in all the experiments of Newton, they appeared sufficiently distinct; but when, by means of a convex lens placed in the hole of the window, they were made to diverge from

from the centre of the sphere to which the mirror was ground, so that they fell perpendicularly on the surface of the mirror, the colours were as vivid as he could make them. In this case he could remove the reflected image to a great distance from the hole, without making the rings disappear; and he could plainly perceive them to arise from their central spots, which changed their colours several times.

"The effect of tarnishing the mirror convinced him, that these coloured rings depended on the first surface of the mirror, and that the second surface, or that which reflected them after they had passed the first, only served to collect them and throw them upon the pasteboard in a quantity sufficient to make them visible, and he was confirmed in his supposition by the following experiments.

"He took a plano-convex object-glass, of six feet focus, and placed it six feet from the pasteboard with its convex side towards it. By this means the rays which fell upon that surface, after being refracted there, were transmitted through the thickness of the glass, parallel to one another, and fell perpendicularly on the plane surface that reflected them, and, in their return, would be collected upon the pasteboard. In these circumstances the rings appeared very distinct after he had tarnished the convex surface, which in this position was next to the light.

"Turning the same glass the contrary way, so that the plane surface was towards the pasteboard, he could perceive none of the rings at the distance of six feet; but they were visible at the distance of three feet: because at that distance the second surface reflected the rays by its concavity directly towards the pasteboard.

"These two experiments demonstrate the use of the second surface of the mirror, and show the manner of placing it to most advantage. Those that follow show the use of the first surface with respect to these rings; and he was led to make them by the casual observation abovementioned.

"Newton, he observes, had remarked, that when he made use of a mirror of the same focus with the first he had used, but of twice the thickness, he found the diameter of the rings much smaller than before. This observation the duke thought favourable to his own conclusions; for if these rings depend upon the first surface, the nearer it is to the second, which only reflects the ray transmitted from it, the larger they ought to appear upon the pasteboard.

"To ascertain this fact, he thought of making use of two moveable surfaces; and to make use of a micrometer to measure the distance between them with exactness. For this purpose he took a metallic mirror belonging to a reflecting telescope, being part of a sphere of ten feet radius; and he fixed it firm upon a foot in which was a groove that carried a light frame, to which was fastened a thin piece of talc tarnished with milk and water. The frame that supported the piece of talc could neither be brought into contact with the mirror, or be removed to the distance of eight or nine inches from it, and the micrometer showed to the utmost exactness the least motion of the frame.

"Having placed this mirror ten feet from the pasteboard, that is, at the distance of the radius of its own sphere, he observed the rings to appear very distinct the form of his mirror being very true: but the diameter of the rings upon the pasteboard varied with the distance of the talc from the mirror; so that they were very large when the talc was near the mirror, and very small when it was placed at the distance of seven or eight inches.

"These experiments proved, that the rings were formed by the first surface, and reflected by the second; but it still remained to be determined in what manner they were formed. He imagined, that the small pencils of rays that were transmitted through the pores of the glass, or any other transparent substance, might suffer a kind of inflection, which might change the cylinder which they formed into a truncated cone, either by means of their different degrees of inflexibility, or by the different distances at which they pass by the edges of the small hole through which they are transmitted. Pursuing this idea, he thought of making use of some body, the pores of which were of a known and determined shape. Instead, therefore, of the piece of talc, he placed a piece of fine linen in the abovementioned frame, stretching it as even as possible, to make the pores formed by the threads more exact and more permeable by the light; and he soon found, with great pleasure, that his conjecture was verified: for, instead of the circular rings which he had before, they were now manifestly square, though their angles were a little rounded; and they were coloured as the others, though the light was not very vivid, on account of the quantity that was stopped by the muslin.

"When, instead of the muslin, he stretched across his frame fine silver wires exactly parallel, at the distance of about three quarters of a line, or a whole line from one another, without any other wires across them; instead of the rings which he had seen before, there was nothing upon the pasteboard but a gleam of white light divided by many small streaks, coloured in a very vivid manner, and in the same manner as the rings."

Thus we have another hypothesis of the formation of colours, namely, by the inflection of light in its passage out from between the solid and impenetrable particles of which bodies are composed. It is, however, very difficult, upon the hypothesis either of Sir Isaac Newton, or that of the Duke de Chaulnes, to give a reason why bodies that are not entirely white, should not appear variously coloured. For, it appears from Sir Isaac Newton's experiments, that plates of different density are capable of exhibiting the same colours; and that where a plate is continually varying in density, it will produce all the colours. Now it is evident, that the plates of which we suppose all natural bodies to be composed, must be similar to one that is perpetually varying in its thickness; for supposing the plates of which any substance is composed to be of any determinate thickness, 9 millionth parts of an inch for instance; such of the rays as are reflected from this plate will be red. But if any of them penetrate to the depth of $11\frac{1}{6}$ of these parts, they will be reflected of a violet colour, &c. and thus must alloy and obscure the red; and so of others. If we suppose the colours to be produced by inflection, it will be equally difficult to account for some particular rays being inflected and others not; seeing we ob-

17 Another theory of colours.

serve

ſerve that all of them are capable of being inflected by every ſubſtance whatever, when they paſs very near it. In ſome caſes too, colours are produced when the light is neither refracted nor inflected, as far as we can judge; and this ſeems to obſcure the theory of chromatics more than any thing we have yet mentioned.

As the experiments we are now about to mention are of the greateſt importance, and in direct terms contradict one of Sir Iſaac Newton's, we ſhall give a full account of them, from Prieſtley's hiſtory of Viſion, &c. with his remarks thereon.

18 One of Sir Iſaac Newton's experiments found to be erroneous

The experiment in queſtion is the eight of Newton's ſecond book of Optics: "He (Sir Iſaac Newton) found, he ſays, that when light goes out of air through ſeveral contiguous refracting mediums, as through water and glaſs, and thence goes out again into air, whether the refracting ſurfaces be parallel or inclined to one another, that light, as often as, by contrary refractions, it is ſo corrected, that it emerges in lines parallel to thoſe in which it was incident, continues ever after to be white: but if the emergent rays be inclined to the incident, the whiteneſs of the emerging light will, by degrees, in paſſing on from the place of emergence, become tinged, at its edges with colours. This he tried by refracting light with priſms of glaſs, placed within a priſmatic veſſel of water.

"By theorems deduced from this experiment, he infers, that the refraction of the rays of every ſort, made out of any medium into air, are known by having the refraction of the rays of any one ſort; and alſo, that the refraction out of one medium into another is found as often as we have the refractions out of them both into any third medium.

"On the contrary, a Swediſh philoſopher (M. Klingenſtierna) obſerves*, that, in this experiment, the rays of light, after paſſing through the water and the glaſs, though they come out parallel to the incident rays, will be coloured; but that the ſmaller the glaſs priſm is, the nearer will the reſult of it approach to Newton's deſcription.

* *Swed. Abhand.* vol. 16. p. 300.

"This paper of M. Klingenſtierna, being communicated to Mr Dollond by M. Mallet, made him entertain doubts concerning Newton's report of the reſult of his experiment; and determined him to have recourſe to experiments of his own.

"He therefore cemented together two plates of parallel glaſs, at their edges, ſo as to form a priſmatic veſſel when ſtopped at the ends or baſes; and the edge being turned downwards, he placed in it a glaſs priſm with one of its edges upwards, and filled up the vacancy with clear water: ſo that the refraction of the priſm was contrived to be contrary to that of the water, in order that a ray of light, tranſmitted through both theſe refracting mediums, might be affected by the difference only between the two refractions. As he found the water to refract more or leſs than the glaſs priſm, he diminiſhed or increaſed the angle between the glaſs plates, till he found the two contrary refractions to be equal, which he diſcovered by viewing an object through this double priſm. For when it appeared neither raiſed nor depreſſed, he was ſatisfied that the refractions were equal, and that the emergent rays were parallel to the incident.

"Now, according to the prevailing opinion, he obſerves, that the object ſhould have appeared through this double priſm in its natural colour; for if the difference of refrangibility had been in all reſpects equal, in the two equal refractions, they would have rectified each other. But this experiment fully proved the fallacy of the received opinion, by ſhowing the divergency of the light by the glaſs priſm to be almoſt double of that by the water; for the image of the object, though not at all refracted, was yet as much infected with priſmatic colours, as though it had been ſeen through a glaſs wedge only whoſe angle was near 30 degrees.

19 Colours produced without refraction or reflection.

"This experiment is the very ſame with that of Sir Iſaac Newton abovementioned, notwithſtanding the reſult was ſo remarkably different: but Mr Dollond aſſures us, that he uſed all poſſible precaution and care in his proceſs; and he kept his apparatus by him, that he might evince the truth of what he wrote, whenever he ſhould be properly required to do it.

"He plainly ſaw, however, that if the refracting angle of the water-veſſel could have admitted of a ſufficient increaſe, the divergency of the coloured rays would have been greatly diminiſhed, or entirely rectified; and that there would have been a very great refraction without colour, as he had already produced a great diſcolouring without refraction: but the inconveniency of ſo large an angle as that of the priſmatic veſſel muſt have been, to bring the light to an equal divergency with that of the glaſs priſm, whoſe angle was about 60°, made it neceſſary to try ſome experiments of the ſame kind with ſmaller angles.

"Accordingly he got a wedge of plate-glaſs, the angle of which was only nine degrees: and, uſing it in the ſame circumſtances, he increaſed the angle of the water-wedge, in which it was placed, till the divergency of the light by the water was equal to that by the glaſs; that is, till the image of the object, though conſiderably refracted by the exceſs of the refraction of the water, appeared nevertheleſs quite free from any colours proceeding from the different refrangibility of the light.

20 Defences of Sir Iſaac.

"Notwithſtanding it evidently appeared, I may ſay to almoſt all philoſophers, that Mr Dollond had made a real diſcovery of ſomething not comprehended in the optical principles of Sir Iſaac Newton, it did not appear to ſo ſenſible a man, and ſo good a mathematician, as Mr Murdoch is univerſally acknowledged to be. Upon this occaſion he interpoſed in the defence, as he imagined, of Sir Iſaac Newton; maintaining, that Mr Dollond's poſitions, which he ſays, he knows not by what miſhap have been deemed paradoxes in Sir Iſaac's theory of light, are really the neceſſary conſequences of it. He alſo endeavours to ſhow, that Sir Iſaac might not be miſtaken in his account of the experiment abovementioned. But admitting all that he advances in this part of his defence, Newton muſt have made uſe of a priſm with a much ſmaller refracting angle than, from his own account of his experiments, we have any reaſon to believe he ever did make uſe of.

"The fact probably was, that Sir Iſaac deceived himſelf in this caſe, by attending to what he imagined to be the clear conſequences of his other experiments; and though the light he ſaw was certainly tinged with colours,

colours, and he must have seen it to be so, yet he might imagine that this circumstance arose from some imperfection in his prisms, or in the disposition of them, which he did not think it worth his while to examine. It is also observable, that Sir Isaac is not so particular in his description of his prisms, and other parts of his apparatus, in his account of this experiment, as he generally is in other cases, and therefore probably wrote his account of it from his memory only.

P. 804. "Much has been said on this experiment; and it is thought very extraordinary that a man of Sir Isaac's accurate attention should overlook a circumstance, the effect of which now appears to be so considerable. But it has happily occurred to Mr Michell, that, as Sir Isaac Newton observes he used to put saccharum saturni into his water to increase its refractive power, the lead, even in this form, might increase the dissipative refraction, as it does in the composition of glass; and if so, that this would account for Newton's not finding the dissipative power of water less than that of his glass prisms, which he otherwise ought to have done, if he had tried the experiment as he said he did.

"Accordingly he included a prism of glass in water, as highly impregnated with saccharum saturni as it would bear, the proportion of saccharum to water being about as 5 to 11. When the image, seen through the water (so impregnated) and a glass prism, was in its natural place, it still was coloured, though very little: he thought not more than a fourth part as much as when seen through plain water, and the prism in its natural place; so that he had no doubt, but that, if his prism had had a little less of the dispersing power, its errors would have been perfectly corrected."

21 Mr Delaval's experiments on the colours of opaque bodies.

Besides the experiments of Mr Delaval above related, and which were made on the colours of transparent bodies, he has lately published an account of some made upon the permanent colours of opaque substances; the discovery of which must be of the utmost consequence in the arts of colour-making and dyeing. These arts, he observes, were in very remote ages carried to the utmost height of perfection in the countries of Phoenicia, Egypt, Palestine, India, &c. and that the inhabitants of these countries also excelled in the art of imitating gems, and tinging glass and enamel of various colours. The colours used in very ancient paintings were as various as those now in use, and greatly superior both in beauty and durability. The paints used by Apelles were so bright, that he was obliged to glaze his pictures with a dark-coloured varnish, lest the eye should be offended by their excessive brightness; and even these were inferior to what had been used among the ancient Egyptians. Pliny complains that the art of painting was greatly decayed in his time; and the moderns were not furnished with any means of retrieving the art until they began to avail themselves of experimental observations.

22 These colours depend chiefly on the division of the colouring particles.

The changes of colour in permanently coloured bodies, our author observes, are produced by the same laws which take place in transparent colourless substances; and the experiments by which they can be investigated consist chiefly of various methods of uniting the colouring particles into larger, or dividing them into smaller masses. Sir Isaac Newton made his experiments chiefly on transparent substances; and in the few places where he treats of others, acknowledges his deficiency of experiments. He makes the following remark, however, on those bodies which reflect one kind of light and transmit another, viz. that "if these glasses or liquors were so thick and massy that no light could get through them, he questioned whether they would not, like other opaque bodies, appear of one and the same colour in all positions of the eye; though he could not yet affirm it from experience." It was the opinion of this great philosopher, that all coloured matter reflects the rays of light, some reflecting the more refrangible and others the less refrangible rays more copiously; and that this is not only a true reason of these colours, but likewise the only reason. He was likewise of opinion that opaque bodies reflect the light from their anterior surface by some power of the body evenly diffused over and external to it. With regard to transparent coloured liquors, he expresses himself in the following manner: "A transparent body which looks of any colour by transmitted light, may also look of the same colour by reflected light; the light of that colour being reflected by the farther surface of that body, or by the air beyond it: and then the reflected colour will be diminished, and perhaps cease, by making the body very thick, and pitching it on the back-side to diminish the reflection of its farther surface, so that the light reflected from the tinging particles may predominate. In such cases the colour of the reflected light will be apt to vary from that of the light transmitted."

To investigate the truth of these opinions Mr Delaval entered upon a course of experiments with transparent coloured liquors and glasses, as well as with opaque and semitransparent bodies. From these he discovered several remarkable properties of the colouring matter; particularly, that in transparent coloured substances, it does not reflect any light; and when, by intercepting the light which was transmitted, it is hindered from passing through such substances, they do not vary from their former colour to any other, but become entirely black (A).

23 No light reflected by the colouring particles.

This incapacity of the colouring particles of transparent bodies to reflect light, being deduced from very numerous experiments, may therefore be held as a general law. It will appear the more extensive, if we consider that, for the most part, the tinging particles of liquors or other transparent substances are extracted from opaque bodies; that the opaque bodies owe their colours to those particles, in like manner as the transparent substances do: and that by the loss of them they are deprived of their colours.

For making his experiments, Mr Delaval used small vials

(A) Here our author observes, that he makes use of the word *colour* only to express those called *primary*; such a mixture of them as does not compose whiteness, or any of the gradations between white and black; such as are called by Sir Isaac Newton, grey, dun, or russet brown.

24 Apparatus for making theſe experiments.

vials of flint glaſs, whoſe form was a parallelopiped, and their height, excluſive of the neck, about two inches, the baſe about an inch ſquare, and the neck two inches in length. The bottom and three ſides of each of theſe vials was covered with a black varniſh; the cylindrical neck, and the anterior ſide, except at its edges, being left uncovered. He was careful to avoid any crevices in the varniſh. That no light might be admitted except through the neck or anterior ſide of the vials.

In theſe experiments it is of importance to have the vials perfectly clean; and as many of the liquors are apt to depoſit a ſediment, they ought to be put into the vials only at the time the experiments are to be made. The uncovered ſide of the vials ſhould not be placed oppoſite to the window through which the light is admitted: becauſe in that ſituation the light would be reflected from the farther ſide of the vial; and our author obſerves that ſmooth black ſubſtances reflect light very powerfully. But as it is a principal object in the experiment that no light be tranſmitted through the liquor, this is beſt accompliſhed by placing the uncovered ſide of the vial in ſuch a ſituation that it may form a right angle with the window.

25 The colouring matter only ſhows itſelf by tranſmitted light.

With theſe precautions our author viewed a great numbers of ſolutions, both of coloured metallic ſalts and of the tinging matter of vegetables; univerſally obſerving, that the colour by reflection was black, whatever it might be when viewed by tranſmitted light. If theſe liquors, however, are ſpread thin upon any white ground, they appear of the ſame colour as when viewed by tranſmitted light: but on a black ground they afford no colour, unleſs the black body be poliſhed; in which caſe the reflection of the light through it produces the ſame effect as tranſmiſſion.

The experiments with tinged glaſſes were in many reſpects analogous to thoſe with tranſparent coloured liquors. For theſe he made ſeveral parcels of colourleſs glaſs, principally uſing one compoſed of equal parts of borax and white ſand. The glaſs was reduced to powder, and afterwards ground, together with the ingredients by which the colours were imparted. "This method (ſays he) of incorporating the tinging particles is greatly preferable to mixing them with the raw materials; and the glaſſes thus compoſed excel moſt others in hardneſs, being ſcarcely inferior in luſtre to real gems."

The reſult of all the experiments made in this manner was, that when matter is of ſuch thinneſs, and the tinge ſo dilute, that light can be tranſmitted through it, the glaſſes then appear vividly coloured; but when they are in larger maſſes, and the tinging matter is more denſely diffuſed through them, they appear black; for theſe, as well as the tranſparent coloured liquors, ſhow their colour only by a tranſmiſſion. The following experiments were made with a view to determine the proportion of tinging matter which produces colour or blackneſs.

26 Experiments to determine the proportion of tinging matter.

1. Glaſs was tinged green by adding to it $\frac{1}{60}$th of its weight of copper; and that whether the latter was uſed in its metallic or calcined ſtate.

2. A blue glaſs was made by the addition of zaffre, a purple one by maganeſe, a red glaſs by gold, and yellow glaſſes by ſilver and calcined iron. A yellow glaſs reſembling a topaz was likewiſe made by the addition of a ſmall quantity of charcoal in powder. The ſame colour was likewiſe procured by the addition of wheat-flour, roſin, and ſeveral other inflammable matters. Small pieces of each of theſe glaſſes being ground by a lapidary, reſembled gems of their different colours.

3. Having formed pieces of ſuch glaſſes about two inches thick, he incloſed them in black cloth on all ſides except their farther and anterior ſurfaces. In this ſituation each of them ſhowed a vivid colour when light was tranſmitted through them; but when the poſterior ſurface was likewiſe covered with the cloth to prevent this tranſmiſſion, no other colour than black was exhibited by any of them.

4. When plates of tranſparent coloured glaſs, ſomewhat thicker than common window-glaſs, were made uſe of, they always exhibited their colours by tranſmitted light.

5. On intercepting the light tranſmitted through theſe coloured plates, they as conſtantly appeared black when placed in ſuch a direction as to form a right angle with the window.

From theſe phenomena Mr Delaval deduced the following obſervations: 1. That the colouring particles do not reflect any light. 2. That a medium, ſuch as Sir Iſaac Newton has deſcribed, is diffuſed over both the anterior and farther ſurfaces of the plates, whereby objects are equally and regularly reflected as by a mirror. Hence, when it is ſaid that light is reflected by the ſurface of any ſubſtance, it ſhould be underſtood from this expreſſion, that the reflection is effected by the medium diffuſed over its ſurface.

27 On the reflection of the light of a candle by coloured glaſſes.

6. When a lighted candle is placed near one of thoſe coloured plates, the flame is reflected by the medium which is diffuſed over the anterior ſurface. The image thus reflected entirely reſembles the flame in ſize and colour; being ſcarcely diminiſhed, and not in the leaſt tinged by the coloured glaſs.

7. If the plate be not ſo intenſely coloured, or ſo maſſy, as to hinder the tranſmiſſion of the light of the candle, there appears a ſecondary image of the flame, which is reflected by the medium contiguous to the farther ſurface of the glaſs; and as the light thus reflected paſſes through the coloured glaſs, it is tinged very vividly.

8. When the glaſs uſed in this experiment is of a green colour, the image of the flame is always of a bright green; and when glaſſes of other colours are uſed, that of a ſecondary flame is always the ſame with that of the glaſs.

9. The ſecondary image is leſs than that reflected from the anterior ſurface. This diminution is occaſioned by the loſs of that part of the light which is abſorbed in paſſing through the coloured glaſs. For whenever any medium tranſmits one ſort of rays more copiouſly than the reſt, it ſtops a great part of the different coloured rays. Much more light alſo is loſt in paſſing through coloured than tranſparent ſubſtances. In making theſe obſervations, it is proper to chooſe coloured plates of glaſs which are not in every part of an equal thickneſs, that the ſecondary image may not coincide with that reflected from the anterior ſurface, and be intercepted by it.

10. When the plates are ſo thick, and ſo copiouſly coloured, that the light cannot penetrate to their farther

ther surface, they appear intensely black in whatever direction they are viewed, and afford no secondary image, but only reflect, from their anterior surface, the flame, or any other objects that are opposed to them. These objects are represented in their own proper colours, and are as free from tinge as those reflected from quicksilvered glass, or specula made of white metals.

Hence again it is manifest, that the colouring particles do not possess any share of reflective power; for if they had any share in this reflection, they would certainly impart some share of colour to the light they reflected. Hence also it appears, that transparent coloured bodies, in a solid state, possess no more reflective power than those in a fluid state.

28 Experiments on the pure colouring particles.

Our author next considers the colouring particles themselves, pure, and unmixed with other media. In order to procure masses made up of such particles, several transparent coloured liquors were reduced to a solid consistence by evaporation. By employing a gentle heat, the colouring matter may thus remain unimpaired; and is capable of having its particles again separated by water or other liquids, and tinging them as before.

In this state the colouring particles reflect no light, and therefore appear uniformly black, whatever substance they have been extracted from. In the course of his experiments, Mr Delaval made use of the infusions of brazil wood, logwood, fustic, turmeric, red saunders, alkanet, sap-green, kermes, and all the other transparent coloured liquors he had tried before, among which were infusions of red and yellow flowers, without observing the least variation in the result.

Some liquors are apt to become totally opaque by evaporation: the reason of which may be the crystallization of saline matters, or the coalescence of the particles into masses, differing considerably in density from the menstrua in which they were dissolved. When this opacity takes place, our author has constantly observed, that they become incapable of entering the pores of wool, silk, or other matters of that kind, or of adhering to their surface; and consequently unfit for the purposes of dyeing. This he supposes to arise from their increased bulk; for the attractive force by which the particles cohere together is weakened in proportion as their bulk increases: so that the degree of magnitude of the colouring particles, which is essential to the opacity of liquors, is inconsistent with the minuteness requisite for dyeing. An instance of this is given in an infusion of fustic. Having infused some of this wood in such a quantity of water, that the latter was saturated with the colouring particles, he evaporated the liquor to a solid consistence with an uninterrupted, but very gentle heat. During every part of the process the liquor continued transparent, and the solid extract yielded by it transmitted a yellow colour when spread thin, but appeared black when thicker masses were viewed. Having prepared another pint of this liquor, he evaporated half the water, and allowed the remainder to become cold. In this state it became turbid and opaque; on filtering, a transparent tincture passed through an opaque fecula remaining on the paper. This fecula did not adhere to the paper, but was easily separable from it: on being dried, it appeared white with a slight tinge of yellow; but was nevertheless soluble in water, and by solution gave a liquid in all respects similar to the original infusion. "From these circumstances (says he) it appears that a given proportion of water, or a sufficient degree of heat, is requisite to the solution of the colouring particles of fustic. And experience evinces, that those particles which are too gross to pass through filtering paper, are incapable of entering the pores or firmly cohering to the surface of bodies. Many ingredients, such as the colouring particles of logwood, kermes, and various other matters, are soluble in water in every proportion; and therefore their infusions are not subject to become opaque or turbid during their evaporation. The solid extracts obtained by evaporation reflect no colour, but are black.

Our author also formed solid masses by mixing a small quantity of drying oil with pigments which consist chiefly of colouring matter; as Prussian blue, indigo, and sap-green. These paints likewise exhibit their respective colours only by transmitted light; appearing entirely black when viewed by reflection. Instances of blackness arising from this density of the colouring matter may be observed in several kinds of fruits, as black currants, cherries, &c. for the juices of these appear red when spread thin on a white ground, or otherwise viewed by transmitted light.

Mr Delaval's next attempt was to consider the action and properties of the colouring particles of opaque bodies themselves, and the means by which these colours are produced. Here our author endeavours to prove, that these colours of opaque bodies appear on the same principles as those already mentioned, which seem black when very dense, but show their proper tinge when spread thin upon a white ground. On this subject the following experiments were made.

1. Grass, and other green leaves of plants, were digested in rectified spirit of wine; by which means a transparent green tincture was obtained. One of the vials formerly mentioned being filled with this liquid, it was observed to transmit a vivid green colour; but the other part of the tincture, which was contiguous to the uncovered side of the vial, reflected no light, and therefore appeared black.

2. Having poured some of the tincture into a China cup, the bottom was thereby made to look green, exactly resembling the colour which had been extracted from the leaves.

3. After the colour had been totally abstracted by the vinous spirit, the leaves remained apparently unaltered, either as to figure or texture; but were entirely white, or had their whiteness slightly tinged with brown.

4. Red, purple, and blue flowers, were also digested in spirit of wine; all of which yielded their colouring matter to the spirit, and became white by being deprived of it. From most of these flowers, however, the spirit acquired either no tinge at all, or only a very faint one; but when acidulated, it became red, and by the addition of an alkali appeared blue, purple, or green, according to the quantity of alkali and the nature of the infusion. In these states, all of them, when viewed

viewed by transmitted light, or poured upon a white ground, showed their colours, but universally appeared black by reflection.

5. Red, purple, and blue flowers, were digested in water slightly acidulated with nitrous acid. Thus, red infusions were obtained, which, by saturation with sea salt, might be preserved for many years.

6. The same liquors were changed, green, blue, or purple, by the addition of an alkali: but here the case was the same as before; all of them yielding vivid colours by transmission, but none by reflection. In making this experiment, care must be taken to add the alkali very gradually; for if too much is put in at once to the red liquor, the intermediate colours between the red and the green will be wanting. To half an ounce of the red infusion it is proper to add, at once, only the smallest quantity that can be taken up on the point of a pen; repeating this addition slowly, until each of the colours be produced.

7. The flowers, after having been repeatedly macerated in acidulated water, lost their colouring matter, and became white.

8. Yellow flowers also communicated their colours to water and to spirit of wine. The infusions and tinctures of these flowers were subjected to the same experiments as had been employed in the examination of the liquors already mentioned; and appeared yellow by transmitted light, but did not reflect any colour.

9. White paper, linen, &c. may be tinged of any of these colours, by dipping them in the infusions; and the consideration of the manner in which the colours are imparted to the linen, affords much insight into the manner in which natural colours are produced. It has already been observed, that, when the colouring matter of plants is extracted from them, the solid fibrous parts, thus divested of their covering, display their natural whiteness. White linen, paper, &c. are formed of such fibrous vegetable matter; which is bleached by dissolving and detaching the heterogeneous colouring particles. When these are dyed or painted with vegetable colours, it is evident that they do not differ in their manner of acting on the rays of light from natural vegetable bodies; both yielding their colours by transmitting, through the transparent coloured matter, the light which is reflected from the white ground. This white matter frequently exists, without any considerable mixture, in plants, while they are in a state of vegetation; as cotton, white flowers, the pith, wood, seeds, roots, and other parts of several kinds of vegetables. When decayed trees, &c. have been long exposed to the atmosphere, their coloured juices are sometimes so perfectly extracted, that the fibres appear white. This white matter is not distinct from the vegetable earth to which plants are reduced by burning †. Mr Delaval has rendered ashes intensely white, by carefully calcining them, and afterwards grinding with a small proportion of nitre, and exposing them to such a degree of heat as would cause the nitre deflagrate with the remaining quantity of phlogiston. Lastly, the ashes were digested with marine acid, in order to dissolve the ferruginous matter diffused through them, and repeatedly washing the remainder in water. Mixing ashes thus purified with borax, and applying a vitrifying heat, an opaque enamel is obtained, remarkable for its whiteness.

† See *Chemistry-Index*.

29 How ashes may be made intensely white.

30 White earth of plants, the only substance in them that reflects the light.

Hence it appears, that the earth which forms the substance of plants is white, and separable from that substance which gives to each its peculiar colour; that whenever it is pure and unmixed, or diffused through colourless media, it shows its native whiteness; and is the only vegetable matter endowed with a reflective power. It may be discovered, however, by other means than that of burning: thus, roses may be whitened by exposing them to the vapour of burning sulphur; an effect which cannot be attributed to the vitriolic acid, but to the phlogiston contained in that vapour. This was proved to be the case, by exposing several kinds of red and purple flowers to the phlogistic vapour issuing from hepar sulphuris; and by this every one of them was whitened; their colour being afterwards restored by the addition of an acid either mineral or vegetable.

31 Colouring matter dissolved by phlogiston.

"Thus (says Mr Delaval) it appears, that the colouring matter of the flowers is not discharged or removed, but only dissolved by the phlogiston; and thereby divided into particles too minute to exhibit any colour. In this state, together with the vegetable juice in which they are diffused, they form a colourless transparent covering, through which the white matter of the flowers is seen untinged. The colouring particles of plants consist principally of inflammable matter; and their solubility in phlogiston, and union with it, are analogous to the action of other inflammable bodies upon each other. Thus, ether dissolves all essential and expressed oils, animal empyreumatic oils, and resins. Sulphur, camphor, and almost all substances abounding in phlogiston, are soluble in oils, ardent spirits, or other inflammable menstrua. The manner in which the red colour of vegetable flowers is restored, appears to be explicable from known chemical laws. When acids are applied to the whitened flowers, they unite with the phlogiston which the sulphur had communicated, and disengage it from the colouring particles; which, being thus extricated, resume their original magnitude and hue. A change of the same kind is also produced by fixed alkali, which, like the acids, has a strong attraction for phlogiston, always changes the whitened flowers to a blue, purple, or green colour.

32 Colours destroyed by the light of the sun.

"In like manner, the action of the rays of light operates upon coloured bodies. Thus, dyed silk, or other substances of that kind, when exposed to the sun's light, are deprived of their colour in every part on which the rays are allowed to act; whilst those preserve their colour which are defended from the light by the folds of the cloth, or intervention of any opaque body. The colours, thus impared, may be restored if acids are applied while the injury is recent; but they are afterwards apt to fly off, on account of that volatility which is constantly imparted by inflammable matter to any other with which it is united."

Our author now proceeds, at considerable length, to prove the identity of the solar light and phlogiston: but as recent experiments have shown that these two are essentially distinct, we omit his argumentation upon his head. The error of his theory in this respect, however, does not in the least affect the doctrine concerning colours above laid down: on the contrary, the latest

latest experiments have determined, that phlogiston, in its grossest form, *viz.* that of common charcoal, manifests a surprising power of whitening various substances; which, according to Mr Delaval's theory, proceeds from the power it has of dissolving the colouring matter with which they are impregnated. This solvent power, according to our author, is manifest in many other instances besides those already mentioned. Silk is whitened by the phlogistic vapours of sulphur: and this operation does not appear to differ from the change effected on flowers by the same vapour. The light of the sun is found to be a necessary and essential agent in bleaching linen, wax, and various other substances; some part of the colouring matter which impairs the whiteness of these bodies not yielding to any other solvent. Red flowers are whitened by the electric spark, of whose inflammable nature we cannot entertain the least doubt; for the spark itself is a bright flame, and yields the same smell which all other phlogistic matters impart. The electric spark, in like manner, changes the blue infusion of turnsole to red (B). The effects which it produces on the turnsole, and on red flowers, do not differ from each other, except in degree only. For when vegetable matter is dissolved, it is changed from blue to red; and, when farther dissolved, it is divided into particles too minute to exhibit any colour.

33 How to distinguish the solutions made by phlogiston from those made by acids.

Solutions effected by means of phlogiston frequently are wrongly attributed to the operation of supposed acid menstrua, as several kinds of substances are capable of being dissolved indiscriminately both by acids and phlogiston. For the purpose of distinguishing, therefore, in any case between the action of the acid solvents and that of the inflammable menstrua, it is proper to examine the nature of the matter by which either of these principles are furnished. It appears from various chemical processes, that alkalies are rendered mild, and capable of crystallization, in proportion as they are united to phlogiston. The phlogisticated alkaline lixivium, when saturated, is perfectly mild; and by a slight evaporation is reduced to a concrete crystalline mass, which does not deliquesce or imbibe the least moisture from the air, and no longer retains any alkaline property. M. Beaumé by an elegant and ingenious experiment, has proved the presence of phlogiston in mild alkalies, and has shown that their power of crystallizing depends upon their union with that principle. He heated in a silver vessel a lixivium of mild alkali, which imparted to the silver a covering or coating of inflammable matter, by which its surface was tarnished and became black. The lixivium was several times poured out of the silver vessel; and after the surface of the metal had been freed from the tarnish, the lixivium was replaced in it, and again heated, by which the tarnish was renewed; and this was repeated till the lixivium no longer communicated any stain to the silver. The causticity of the lixivium was increased in proportion as it imparted its phlogiston to the silver; and at the end of the process the alkali became perfectly caustic, and incapable of crystallizing.

Our author now goes on to prove, that fixed air is not an acid, nor a compound of air and phlogiston, as is now generally believed, but rather entirely of a phlogistic nature. For an account of his arguments in favour of this opinion, see the article FIXED AIR: here we shall only consider his farther experiments on colours.

"From the preceding experiments (says he) it appears, that the colouring particles of flowers and leaves are soluble in acid, alkaline, and phlogistic menstrua. The other parts of vegetables consist of materials similar to those which are contained in their flowers and leaves, and undergo the same changes from the same causes. Having extracted from logwood its colouring particles by repeatedly boiling it in water, the wood was thus deprived of its yellow colour, and assumed a brown hue similar to that of oak-wood. Some pieces of it thus deprived of its colour were then macerated in aquafortis; and after they had undergone the action of that acid, they were washed in a sufficient quantity of water. The wood was thus reduced to whiteness."

34 Logwood affords only a yellow tincture with water.

Here our author observes, that though most authors who treat of colouring substances describe logwood as of a red colour, he was never able to procure any other colour from it but yellow. It imparts yellow and orange colours to distilled water. Other waters extract a red tinge from it by means of the alkali which they contain. These observations are also applicable to the other dyeing woods, kermes, and various other articles of the materia tinctoria. By a similar treatment, fustic wood also lost its colouring matter, and became white.

The results of all the experiments above related are, that the colouring matter of plants does not exhibit any colour by reflection, but by transmission only; that their solid earthy substance is a white matter; and that it is the only part of vegetables which is endowed with a reflective power; that the colours of vegetables are produced by the light reflected from this white matter, and transmitted from thence through the coloured coat or covering which is formed on its surface by the colouring particles; that whenever the colouring matter is either discharged or divided by solution into particles too minute to exhibit any colour, the solid earthy substance is exposed to view, and displays that whiteness which is its distinguishing characteristic.

34 Colouring matter of animal substances.

Mr Delaval next proceeds to examine the coloured parts of animal substances, and finds them exactly similar, with regard to the manner in which the colour is produced, to the vegetable bodies already treated of. The tinctures and infusions of cochineal and of kermes yield their colours when light is transmitted through them, but show none by reflection. On diluting fresh ox-gall with water, and examining it in the phials already mentioned, that part of it which was in the neck of the phial, and viewed by transmitted light, was yellow; but the anterior surface was black, and reflected no colour. Flesh derives its colour entirely from the blood, and when deprived of it the fibres and vessels are perfectly white; as are likewise the membranes

(B) This effect of the electric spark is now known to be produced, not by its phlogistic nature, but by the generation of an acid.

branes, ſinews, and bones, when freed from their aqueous and volatile parts; in which caſe they are a mere earth, unalterable by fire, and capable of imparting an opaque whiteneſs to glaſs.

35 Of the colour of blood.

On examining blood diluted with water in one of the phials formerly deſcribed, it tranſmitted a red colour, and the anterior ſurface was almoſt, but not entirely, black; for it received a ſlight hue of brown from ſome coagulated particles that were ſuſpended in the liquor. In order to procure blood ſufficiently diluted, and at the ſame time equably and perfectly diſſolved, he mixed as much cruor with ſpirit of ſal ammoniac as imparted a bright colour to it. The liquor being then viewed in the phial, that part which was contained in the neck, and tranſmitted the light, appeared of a fine red; but the anterior part reflecting no light, was intenſely black. Hence it appears, that the florid red colour of the fleſh ariſes from the light which is reflected from the white fibrous ſubſtance, and tranſmitted back through the red tranſparent covering which the blood forms on every part of it.

Blood, when recently drawn, does not aſſume the appearance common to tranſparent coloured liquors; for theſe, when too maſſy to tranſmit light from their farther ſurfaces, always appear black; but blood, when recently drawn, always ſhows a fine red colour, in whatever way it be viewed. This is occaſioned by a white matter diffuſed through the blood; and which is eaſily ſeparated from the cruor, by dividing it after coagulation into a number of thin pieces, and waſhing in a ſufficient quantity of pure water. Thus the water acquires a red colour, and ought to be changed daily. In a few days it will acquire no more tinge; and the remaining maſſes of the cruor are no longer red, but white.

36 Of the ſhells of lobſters.

In like manner, the red colour of the ſhells of lobſters, after boiling, is no more than a mere ſuperficial covering ſpread over the white calcareous earth of which the ſhells are compoſed, and may be eaſily removed from the ſurface by ſcraping or filing. Before the application of heat, this ſuperficial covering is much denſer; inſomuch that, in ſome parts of the ſhell, it appears quite black, being too thick to admit the paſſage of the light to the ſhell and back again; but where this tranſparent blue colour of the unboiled lobſter is thinner, it conſtantly appears like a blue film. In like manner, the colours of the eggs of certain birds are entirely ſuperficial, and may be ſcraped off, leaving the white calcareous earth expoſed to view.

37 Of feathers.

The caſe is the ſame with feathers, which owe their colours entirely to a very thin layer of ſome tranſparent matter upon a white ground. Our author aſcertained this by ſcraping off the ſuperficial colours from certain feathers which were ſtrong enough to bear the operation; and thus ſeparated the coloured layers from the white ground on which they had been naturally ſpread. The lateral fibres of the feathers cannot indeed have their ſurfaces ſeparated in this manner; but their texture, when viewed by a microſcope, ſeems to indicate, that the colours are produced on them by no other means than thoſe already related. In the examination of ſome animal ſubjects where the colouring matter could not be ſeparated by chemical means, our author had recourſe to mechanical diviſion; but this can only be employed when the principal part of the white ſubſtance is unmixed with the coloured coat or covering which is ſpread upon its ſurface. All of them, however, by whatever means their colours could be ſeparated, ſhowed that they were produced in the ſame manner, namely, by the tranſmiſſion of light from a white ground through a tranſparent coloured medium.

38 Of the colours of mineral ſubſtances.

The coloured ſubſtances of the mineral kingdom are very numerous, and belong principally to two claſſes, *viz.* earths and metals. The former, when pure, are all perfectly white, and their colours ariſe from phlogiſtic or metallic mixtures. Calcareous earths, when indurated, conſtitute marble, and may be tinged with various colours by means of metallic ſolutions; all which are ſimilar in their nature to the dyes put upon ſilk, cotton, or linen, and invariably proceed from the ſame cauſe, *viz.* the tranſmiſſion of light through a very thin and tranſparent coloured medium. Flints are formed from ſiliceous earth, and owe their colour to phlogiſton. When ſufficiently heated, they are rendered white by the loſs of the inflammable matter which produced their colour. When impregnated with metals, they form agates, cornelians, jaſper, and coloured cryſtals. The coloured gems alſo receive their different hues from metals; and all of them may be imitated by glaſſes tinged with ſuch phlogiſtic or metallic matters as enter into the compoſition of the original ſubſtances.

39 Of metals.

Thus our author concludes, that the coloured earths, gems, &c. exhibit their various tints in the ſame manner with other ſubſtances; *viz.* by the tranſmiſſion of light reflected from a white ground. Our author, however, proceeds farther; and aſſerts, that even the colours of metals themſelves are produced in the ſame manner.

"Gold (ſays he) exhibits a white light, which is tinged with yellow. I have uſed this expreſſion, becauſe it appears from experiment that gold reflects a white light, and that its yellow colour is a tinge ſuperadded to its whiteneſs. The experiment is thus ſet forth by Sir Iſaac Newton. Gold in this light (that is, a beam of white light) appears of the ſame yellow colour as in day light; but by intercepting at the lens a due quantity of the yellow-making rays, it will appear white like ſilver, as I have tried; which ſhows, that its yellowneſs ariſes from the exceſs of the intercepted rays, tinging that whiteneſs with their colour when they are let paſs.

"I have already ſhown, by numerous experiments, in what manner coloured tinges are produced; and it uniformly appears, from all theſe experiments, that colours do not ariſe from reflection, but from tranſmiſſion only. A ſolution of ſilver is pellucid and colourleſs. A ſolution of gold tranſmits yellow, but reflects no colour. This metal alſo, when united with glaſs, yields no colour by reflection, but by tranſmiſſion only. All theſe circumſtances ſeem to indicate, that the yellow colour of gold ariſes from a yellow tranſparent matter, which is a conſtituent part of that metal; that it is equally mixed with the white particles of the gold, and tranſmits the light which is reflected by them, in like manner as when ſilver is gilt, or foils are made by covering white metals with tranſparent colours. But theſe factitious coverings are only ſuperficial; whereas the yellow matter of gold is diffuſed throughout the whole ſubſtance of the metal, and

and appears to envelope, and cover each of the white particles. In whatsoever manner the yellow matter of gold is united to its white substance, it exists in a rare state; for it bears only the same proportion to the white particles of the gold as that of the yellow-making rays which were intercepted bears to all the other rays comprised in the white light of the sun.

"Sir Isaac Newton has shown, that when spaces or interstices of bodies are replenished with media of different densities, the bodies are opaque; that those superficies of transparent bodies reflect the greatest quantity of light which intercede media that differ most in their refractive densities; and that the reflections of very thin transparent substances are considerably stronger than those made by the same substances of a greater thickness. Hence the minute portions of air, or of the rarer medium, which occupies spaces void of other matter, reflect a vivid white light whenever their surfaces are contiguous to media whose densities differ considerably from their own; so that every small mass of air, or of the rarer medium, which fills the pores or interstices of dense bodies, is a minute white substance. This is manifest in the whiteness of froth, and of all pellucid colourless bodies; such as glass, crystal, or salts, reduced to powder, or otherwise flawed; for in all these instances a white light is reflected from the air or rarer medium which intercede the particles of the denser substances whose interstices they occupy."

From these principles our author takes occasion to explain the reason why the particles of metals which yield no colour by incident light when suspended in their solvents, are disposed to exhibit colours when separated from them. Hence also we see why opaque white substances are rendered pellucid by being reduced to uniform masses whose component parts are every where nearly of the same density; for as all pellucid substances are rendered opaque and white by the admixture of pellucid colourless media of considerably different densities, they are again deprived of their opacity by extricating these media which kept their particles at a distance from each other: thus froth or snow, when resolved into water, lose their whiteness, and assume their former pellucid appearance. In like manner, by proper fluxes, the opaque white earths are reduced to pellucid colourless glasses; because all reflections are made at the surfaces of bodies differing in density from the ambient medium, and in the confines of equally dense media there is no reflection.

As the calces of metals are enabled to reflect their colours by the intervention of the particles of air; so, when mixed with oil in the making of paints, they always assume a darker colour, because the excess of the density of oil over that of air forms a sensible difference when comparatively considered with respect to the specific gravity of the rarer metals. From this cause perceptibly less light is reflected from the moleculæ of oil than from those of air, and consequently the mass appears darker. The case, however, is different with such paints as are formed of the denser metals; as vermilion, minium, &c.: for though oil differs very considerably from air in its specific density, yet it also differs very much in this respect from the denser metallic powders; and the moleculæ of oil which divide their particles act upon the light so strongly, that the reflection occasioned by them cannot be distinguished from those which are caused by rarer media. Hence, though we mix vermilion or minium with oil, the colour is not sensibly altered.

40 Objections to his theory of metallic colours.

This part of our author's theory, however, seems liable to objection: for though it be true that the calces of some metals are denser than others, yet that is, comparatively speaking, but in a very small proportion; nor is even the difference of density between oil and the calces of the heavier metals at all comparable to that between the density of air and oil. Thus, tho' the calx of iron may be 10 or 11 times more dense than oil; yet, as the latter is between 500 and 600 times denser than air, the small difference between the oil and metallic calx ought to be imperceptible. In this respect, indeed, there are considerable differences with regard to the oils employed, which cannot be supposed to arise from the mere circumstance of density. Thus the colour of vermilion, when mixed with turpentine-varnish, is much brighter than with linseed-oil; and yet the difference between the densities of linseed-oil and turpentine-varnish is very trifling. The mere action of heat likewise has a surprising effect in this case. Thus the red calx of iron, called *scarlet oker*, by being only heated a certain degree, appears of a very dark purple, resuming its red colour when cold; and this variation may be induced as often as we please by only heating it over the fire in a shovel. In like manner, by gradually heating red lead, it may be made to assume a most beautiful crimson colour; which growing gradually darker, becomes at last almost quite black. On cooling, if the heat has not been raised too high, it gradually returns through the same shades of colour, until at last it fixes in its original hue. These immense differences in colour cannot by any means be attributed either to the expulsion of air or to an alteration in density. The fire indeed does certainly expand these calces as well as other bodies; but as the medium interspersed between their particles is thus also expanded, the colour ought at least to remain the same, if not to become lighter, on account of the superior expansion of air to that of metal by the same degree of heat. It would seem, therefore, that the action of the element of fire itself has a considerable share in the production of colours; and indeed its share in the operations of nature is so great, that we might well think it strange if it should be entirely excluded from this.

41 Of the colours of semipellucid substances.

With regard to semipellucid substances, which appear of one colour by incident and another by transmitted light, our author likewise endeavours to show, that no reflection is made by the coloured matter, but only by the white or colourless particles. They consist of pellucid media, throughout which white or colourless opaque particles are dispersed. The latter are disposed at such distances from each other, that some of the incident rays of light are capable of passing through the intervals which intercede them, and thus are transmitted through the semipellucid mass. Some sorts of rays penetrate through such masses, while others which differ from them in their refrangibility are reflected by the white or colourless particles; and from thence are transmitted through the pellucid part of the medium which intervenes between the reflecting particles and the anterior surface of the mass. On the same principle our author explains the blue colour of the

the ſky, the green colour of the ſea, and other natural phenomena: and from his numerous experiments on this ſubject at laſt concludes, "that the power by which the ſeveral rays of light are tranſmitted through different media is inherent in the particles themſelves, and therefore is not confined to the ſurfaces of ſuch media. For if the tranſmiſſive force was exerted at the ſurface only, the thinner plates of coloured ſubſtances would act upon the rays as powerfully as thicker maſſes. But it appears from experiment, that in proportion as the rays paſs through different thickneſſes of coloured media, they exhibit colours differing not only in degree, but frequently in ſpecies alſo.

42 How colours are ſhown by tranſmitted light

"The ſun's light, by which bodies are illuminated, conſiſts of all the rays by which a white light is compounded. Theſe rays, in their entire and undivided ſtate, are incident upon the opaque particles of ſemipellucid ſubſtances, and upon the colouring particles of tranſparent-coloured ſubſtances, whenever theſe media are expoſed to the light. When the rays accede to the opaque particles of ſemipellucid ſubſtances, ſome ſorts of them are reflected back from the anterior ſurface of thoſe particles: the other ſorts of rays, which are not reflected back, are diverted from the direction which is oppoſite to the anterior ſurface of the opaque particles, and paſſing through the intervals between the particles, are tranſmitted through the maſs.

"When the rays are incident upon the particles of tranſparent coloured bodies, none of them are reflected back; becauſe the colouring particles are not endowed with any reflective power: but ſome of the rays are either ſtopped at the anterior ſurface of the particles, or are diverted into ſuch directions as render them incapable of paſſing towards the farther ſide of the maſs; and conſequently ſuch rays cannot be tranſmitted. The rays which are not thus intercepted or diſperſed, are tranſmitted in the ſame manner as thoſe which paſs through ſemipellucid media. Thus it is evident, that the coloured rays which are tranſmitted through ſemipellucid ſubſtances are *inflected* by the opaque particles: and thoſe which are tranſmitted through tranſparent-coloured ſubſtance are *inflected* by the colouring particles. From the preceding obſervations likewiſe it appears, that the particles of coloured media inflect the ſeveral ſorts of rays according to the ſeveral ſizes and denſities of the particles; alſo in proportion to the inflammability of the media which owe their colour to them; and it is manifeſt that the tranſmiſſion of coloured rays depends upon their inflection. All theſe obſervations are conformable to Sir Iſaac Newton's doctrine, that the rays of light are reflected, refracted, and inflected, by one and the ſame principle acting variouſly in various circumſtances."

The moſt remarkable part of Mr Delaval's doctrine is that concerning the metals; for the better underſtanding of what we ſhall premiſe a ſhort abſtract of his general doctrine concerning white bodies, and the manner in which light is reflected by them. "All the earths (he obſerves), which in their natural ſtate are of a pure white, conſtitute tranſparent colourleſs media when vitrified with proper fluxes, or when diſſolved in colourleſs menſtrua; and the ſaline maſſes obtainable from their ſolutions are tranſparent and colourleſs while they retain the water which is eſſential to their cryſtallization, and are not flawed or reduced to powder; but after their pores and interſtices are opened in ſuch a manner as to admit the air, they become then white and opaque by the entrance of that rare medium. The earthy particles which form the ſolid parts of bodies generally exceed the others in denſity; conſequently theſe particles, when contiguous to the rare media already mentioned, muſt reflect the rays of light with a force proportionate to their denſity. The reflective power of bodies does not depend merely upon their exceſs of denſity, but upon their difference of denſity, with reſpect to the ſurrounding media. Tranſparent colourleſs particles, whoſe denſity is greatly inferior to that of the media they come between, alſo powerfully reflect all ſorts of rays, and thereby become white. Of this kind are the air or other rare fluids which occupy the interſtices of liquors; and in general of all denſer media into whoſe interſtices ſuch rare particles are admitted.

43 Of the manner in which light is reflected from white bodies.

"Hence we may conclude, that white opaque bodies are conſtituted by the union or contiguity of two or more tranſparent colourleſs media differing conſiderably from each other in their reflective powers. Of theſe ſubſtances we have examples in froth, emulſions, or other imperfect combinations of pellucid liquors, milk ſnow, calcined or pulverized ſalts, glaſs or cryſtal reduced to powder, white earths, paper, linen, and even thoſe metals which are called white by mineralogiſts and chemiſts: for the metals juſt mentioned do not appear white unleſs theſe ſurfaces be rough? as in that caſe only there are interſtices on their ſurface ſufficient to admit the air, and thus make a reflection of a white and vivid light.

"But the poliſhed ſurfaces of metallic mirrors reflect the incident rays equably and regularly, according to their ſeveral angles of incidence; ſo that the reflected rays do not interfere with each other, but remain ſeparate and unmixed, and therefore diſtinctly exhibit their ſeveral colours. Hence it is evident, that white ſurfaces cannot act upon the light as mirrors; becauſe all the rays which are reflected from them are blended in a promiſcuous and diſorderly manner.

"The abovementioned phenomena give much inſight into the nature and cauſe of opacity; as they clearly ſhow, that even the rareſt tranſparent colourleſs ſubſtances, when their ſurfaces are adjacent to media differing greatly from them in refractive power, may thereby acquire a perfect opacity, and may aſſume a reſplendency and hue ſo ſimilar to that of white metals, that the rarer pellucid ſubſtances cannot by the ſight be diſtinguiſhed from the denſe opaque metals. And this ſimilarity to the ſurface of metals occurs in the rare pellucid ſubſtances, not only when, from the roughneſs of their ſurfaces, they reſemble unpoliſhed metals in whiteneſs, but alſo when, from their ſmoothneſs, they reſemble the poliſhed ſurfaces of metals.

44 Of the cauſe of opacity.

"Metals ſeem to conſiſt entirely of tranſparent matter, and to derive their apparent opacity and luſtre ſolely from the copious reflection of light from their ſurfaces. The analogy between the metals and tranſparent media, as far as reſpects their optical properties, will appear from the following conſiderations.

"1. All metals diſſolved in their proper menſtrua are

 tranſ-

transparent. 2. By the union of two or more transparent media, substances are constituted which are similar to metals in their opacity and lustre, as plumbago and marcasites. 3. The transparent substances of metals, as well as those of minerals, by their union with phlogiston, acquire their strong reflective powers from which their lustre and opacity arise. 4. The surfaces of pellucid media, such as glass or water, assume a metallic appearance, when by their smoothness, difference of density with respect to the contiguous media, or any other cause, they are disposed copiously to reflect the light.

"From all these considerations it is evident that opaque substances are constituted by the union or contiguity of transparent colourless media, differing from one another in their reflective powers: and that, when the common surface, which comes between such media, is plane, equal, and smooth, it reflects the incident rays equally and regularly as a mirror; but when the surface is rough and unequal, or divided into minute particles, it reflects the incident rays irregularly and promiscuously in different directions, and consequently appears white."

45 Theory of colours still uncertain.

From all those experiments we can only conclude, that the theory of colours seems not yet to be determined with certainty; and very formidable, perhaps unanswerable, objections, might be brought against every hypothesis on this subject that hath been invented. The discoveries of Sir Isaac Newton, however, are sufficient to justify the following

## APHORISMS.

1. All the colours in nature proceed from the rays of light.

2. There are seven primary colours: which are red, orange, yellow, green, blue, indigo, and violet.

3. Every ray of light may be separated into the seven primary colours.

4. The rays of light in passing through the same medium have different degrees of refrangibility.

5. The difference in the colours of light arises from its different refrangibility: that which is the least refrangible producing red; and that which is the most refrangible violet.

6. By compounding any two of the primary colours, as red and yellow, or yellow and blue, the intermediate colour, as orange or green, may be produced.

7. The colours of bodies arise from their dispositions to reflect one sort of rays, and to absorb the other: those that reflect the least refrangible rays appearing red; and those that reflect the most refrangible violet.

8. Such bodies as reflect two or more sorts of rays appear of various colours.

9. The whiteness of bodies arises from their disposition to reflect all the rays of light promiscuously.

10. The blackness of bodies proceeds from their incapacity to reflect any of the rays of light (c).

## *Entertaining* EXPERIMENTS, *founded on the preceding Principles.*

I. *Out of a single colourless ray of light to produce seven other rays, which shall paint, on a white body, the seven primary colours of nature.*

PROCURE of an optician a large glass prism DEF, well polished, two of whose sides must contain an angle of about sixty-four degrees. Make a room quite dark, and in the window shutter AB, cut a round hole, about one-third of an inch in diameter, at C, through which a ray of light LI passing, falls on the prism DEF: by that it is refracted out of the direction IT, in which it would have proceeded into another GH; and, falling on the paper MNSX, will there form an oblong spectrum PQ, whose ends will be semicircular, and its sides straight; and if the distance of the prism from the paper be about eighteen feet, it will be ten inches long, and two inches wide. This spectrum will exhibit all the primary colours: the rays between P and V, which are the most refracted, will paint a deep violet: those between V and I, indigo; those between I and B, blue; those between B and G, green; those between G and Y, yellow; those between Y and O, orange; and those between O and R, being the least refracted, an intense red. The colours between these spaces will not be every where equally intense, but will incline to the neighbouring colour: thus the part of the orange next to R, will incline to a red; that next to Y, to a yellow: and so of the rest. Plate CXXXV. fig. 1

II. *From two or more of the primary colours, to compose others that shall, in appearance, resemble those of the former.*

By mixing the two homogeneal colours red and yellow, an orange will be produced similar in appearance to that in the series of primary colours; but the light of the one being homogeneal, and that of the other heterogeneal, if the former be viewed through a prism it will remain unaltered, but the other will be resolved into its component colours red and yellow. In like manner other contiguous homogeneal colours may compound new colours; as by mixing yellow and green, a colour between them is formed; and if blue be added, there will appear a green that is the middle colour of those three. For the yellow and blue, if they are equal in quantity, will draw the intermediate green equally toward them, and keep it, at it were, in equilibrio, that it verge not more to the one than to the other. To this compound green there may be added some red and violet; and yet the green will not immediately cease, but grow less vivid; till by adding more red and violet it will become more diluted; and at last by the prevalence of the added colours, it will be overcome, and turned into some anomalous colour.

If the sun's white, composed of all kinds of rays, be added

(c) From hence it arises, that black bodies, when exposed to the sun, become sooner heated than all others.

Fig. 3

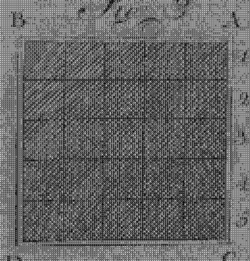



Fig. 2

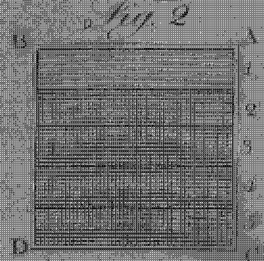



Fig. 1

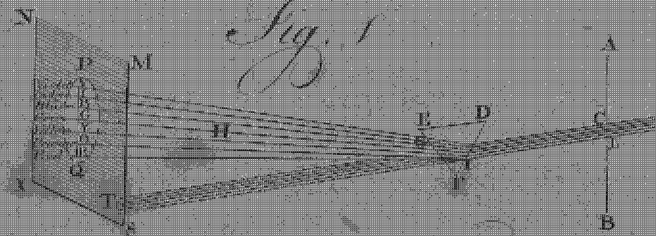



Fig. 7


Fig. 4

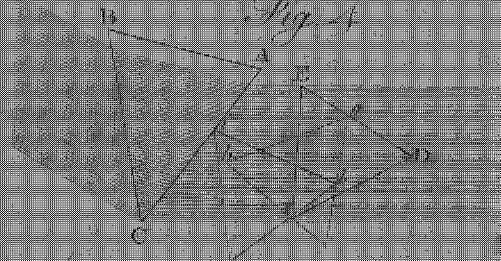



Fig. 9

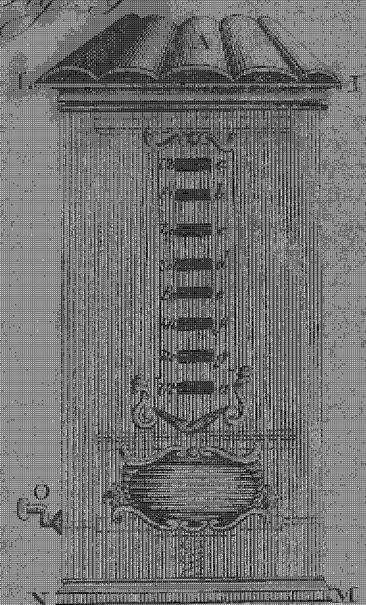



Fig. 8

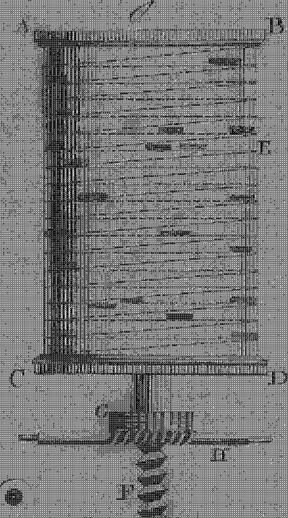
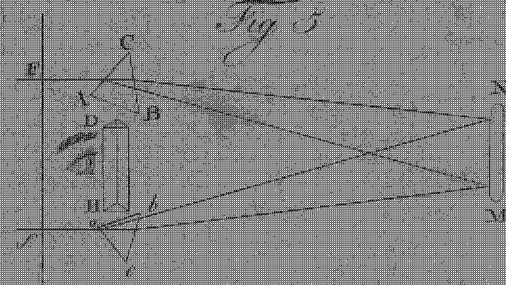
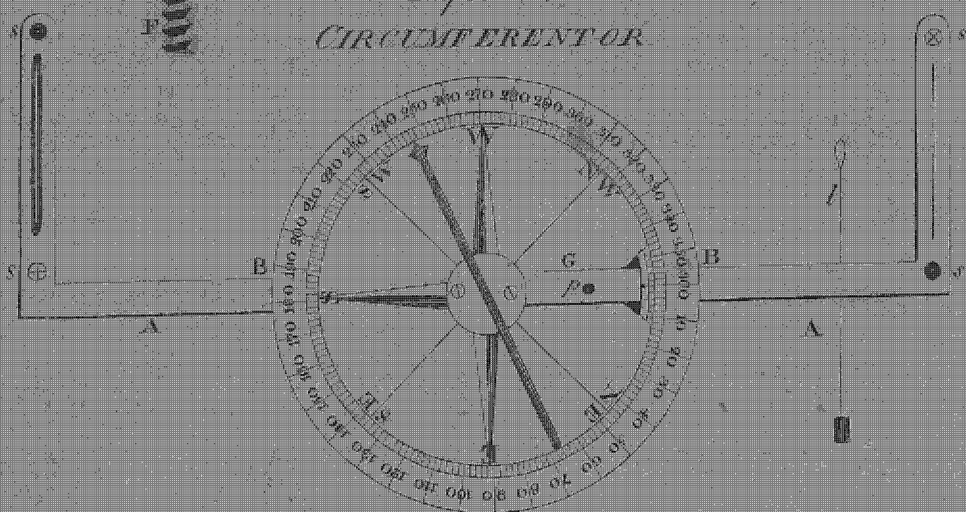



Fig. 6

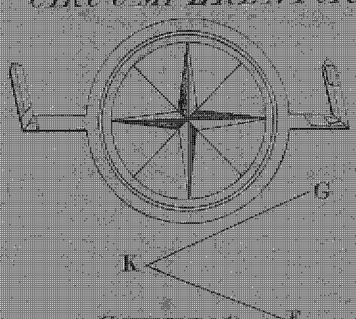

Fig. 5



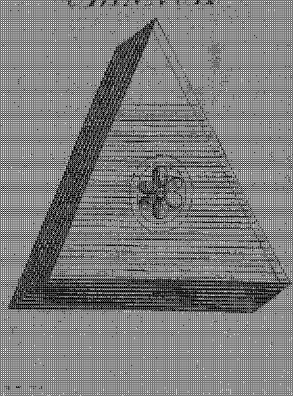

*Improved,*
*CIRCUMFERENTOR*




*CIRCUMFERENTOR*




*CHINNOR*



*Druidical CIRCLE*

Scot Philad a

added to any homogeneal colour, that colour will not vanish, nor change its species, but be diluted; and by adding more white, it will become continually more diluted. Lastly, if red and violet be mixed, there will be generated, according to their various proportions, various purples, such as are not like, in appearance, to the colour of any homogeneal light; and of these purples, mixed with blue and yellow, other new colours may be composed.

III. *Out of three of the primary colours, red, yellow, and blue, to produce all the other prismatic colours, and all that are intermediate to them.*

Fig. 2. PROVIDE three panes of glass of about five inches square; and divide each of them, by parallel lines, into five equal parts. Take three sheets of very thin paper; which you must paint, lightly, one blue, another yellow, and the third red (D). Then paste on one of the glasses five pieces of the red paper; one of which must cover the whole glass, the second only the four lower divisions, the third the three lower, the fourth the two lowest, and the fifth the last division only. On the other two glasses five pieces of the blue and yellow papers must be pasted in like manner. You must also have a box of about six inches long, and the same depth and width as the glasses; it must be black on the inside: let one end be quite open, and in the opposite end there must be a hole large enough to see the glasses completely. It must also open at the top, that the glasses may be placed in it conveniently.

When you have put any one of these glasses in the box, and the open end is turned toward the sun, you will see five distinct shades of the colour it contains. If you place the blue and yellow glasses together, in a similar direction, you will see five shades of green distinctly formed. When the blue and red glasses are placed, a bright violet will be produced; and by the red and yellow, the several shades of orange.

Fig. 3. If, instead of placing these glasses in a similar position, you place the side AB of the yellow glass against the side BD of the blue, you will see all the various greens that are produced by nature (E); if the blue and red glasses be placed in that manner, you will have all the possible varieties of purples, violets, &c.; and, lastly, if the red and orange glasses be so placed, there will be all the intermediate colours, as the marygold, aurora, &c.

IV. *By means of the three primary colours, red, yellow, and blue, together with light and shade, to produce all the gradations of the prismatic colours.*

ON seven square panes of glass, paste papers that are painted with the seven prismatic colours, in the same manner as in the last experiment. The colours for the orange, green, indigo, and violet, may be made by mixing the other three. Then with bistre (F), well diluted, shade a sheet of very thin paper, by laying it light on both its sides. With pieces of this paper cover four-fifths of a glass, of the same size with the others, by laying one piece on the four lowest divisions, another on the three lowest, a third on the two lowest, and the fourth on the lowest division only, and leaving the top division quite uncovered. When one of the coloured glasses is placed in the box, together with the glass of shades, so that the side AB of the one be applied to the side BC of the other, as in fig. 3. the several gradations of colours will appear shaded in the same manner as a drapery judiciously painted with that colour.

It is on this principle that certain French artists have proceeded in their endeavours to imitate, by designs printed in colours, paintings in oil: which they do by four plates of the same size, on each of which is engraved the same design. One of these contains all the shades that are to be represented, and which are painted either black or with a dark grey. One of the three other plates is coloured with blue, another with red, and the third with yellow; each of them being engraved in those parts only which are to represent that colour (G); and the engraving is either stronger or weaker, in proportion to the tone of colour that is to be represented (H).

These four plates are then passed alternately under the press; and the mixture of their colours produces a print that bears no small resemblance to a painting. It must be confessed, however, that what has been hitherto done of this kind falls far short of that degree of perfection of which this art appears susceptible. If they who engrave the best in the manner of the crayon were to apply themselves to this art, there is reason to expect

(D) Water-colours must be used for this purpose: the blue may be that of Prussia, and very bright; the red, carmine; and the yellow, gambooge, mixed with a little saffron. These colours must be laid very light and even, on both sides of the paper.

(E) In the first position of the glasses, the quantity of blue and yellow being equal, the same sort of green was constantly visible: but by thus inverting the glasses, the quantity of the colours being constantly unequal, a very pleasing variety of tints is produced.

(F) The bistre here used must be made of soot, not that in stone.

(G) When a red drapery is required, it is engraved on the plate assigned to that colour; and so of yellow and blue: but if one of the other colours be wanting, suppose violet, it must be engraved on those that print the red and blue: and so of the rest. The plates of this kind have been hitherto engraved in the manner of mezzotinto; but these, unless they are skilfully managed, soon become smutty. Engravings in the manner of the crayon will perhaps answer better.

(H) The principal difficulty in this sort of engraving arises from a want of a skilful management, in giving each plate that precise degree of engraving which will produce the tone of colour required. If a bright green is to be represented, there should be an equal quantity of graving on the red and yellow plates: but if an olive green, the yellow plate should be engraved much deeper than the red.

expect they would produce far more finished pieces than we have hitherto seen.

### V. *To make figures appear of different colours successively.*

Fig. 4. MAKE a hole in the window-shutter of a dark room, through which a broad beam of light may pass, that is to be refracted by the large glass prism ABC, which may be made of pieces of mirrors cemented together, and filled with water. Provide another prism DEF, made of three pieces of wood; through the middle of this there must pass an axis on which it is to revolve. This prism must be covered with white paper; and each of its sides cut through in several places, so as to represent different figures, and those of each side should likewise be different. The inside of this prism is to be hollow, and made quite black, that it may not reflect any of the light that passes through the sides into it. When this prism is placed near to that of glass, as in the figure, with one of its sides EF perpendicular to the ray of light, the figures on that side will appear perfectly white: but when it comes into the position *g h*, the figures will appear yellow and red; and when it is in the position *k l*, they will appear blue and violet. As the prism is turned round its axis, the other sides will have a similar appearance. If instead of a prism, a four or five sided figure be here used, the appearances will be still further diversified.

This phenomenon arises from the different refrangibility of the rays of light. For when the side EF is in the position *g h*, it is more strongly illuminated by the least refrangible rays; and wherever they are predominant, the object will appear red or yellow. But when it is on the position *k l*, the more refrangible rays being then predominant, it will appear tinged with blue and violet.

### VI. *The solar magic lantern.*

PROCURE a box, of about a foot high, and eighteen inches wide, or such other similar dimensions as you shall think fit; and about three inches deep. Two of the opposite sides of this box must be quite open; and in each of the other sides let there be a groove, wide enough to pass a stiff paper or pasteboard. This box must be fastened against a window on which the sun's rays fall direct. The rest of the window should be closed up, that no light may enter. Provide several sheets of stiff paper, which must be blacked on one side. On these papers cut out such figures as you shall think proper: and placing them alternately in the grooves of the box, with their blacked sides towards you, look at them through a large and clear glass prism; and if the light be strong, they will appear to be painted with the most lively colours in nature. If you cut on one of these papers the form of the rainbow, about three quarters of an inch wide, you will have a lively representation of that in the atmosphere.

This experiment may be further diversified, by pasting very thin papers, lightly painted with different colours, over some of the parts that are cut out: which will appear to change their colours when viewed through the prism, and to stand out from the paper, at different distances, according to the different degrees of refrangibility of the colours with which they are painted. For greater convenience, the prism may be placed in a stand on a table, at the height of your eye, and made to turn round on an axis, that when you have got an agreeable prospect, you may fix it in that position.

### VII. *The prismatic camera obscura.*

MAKE two holes F, *f*, in the shutter of a dark chamber, near to each other; and against each hole place a prism ABC, and *a b c*, in a perpendicular direction, that their spectrums NM may be cast on the paper in a horizontal line, and coincide with each other; the red and violet of the one being in the same part with those of the other. The paper should be placed at such a distance from the prisms that the spectrum may be sufficiently dilated. Provide several papers nearly of the same dimensions with the spectrum, cross these papers, and draw lines parallel to the divisions of the colours. In these divisions cut out such figures as you shall find will have an agreeable effect, as flowers, trees, animals, &c. When you have placed one of these papers in its proper position, hang a black cloth or paper behind it, that none of the rays that pass through may be reflected and confuse the phenomenon. The figures cut on the paper will then appear strongly illuminated with all the original colours of nature. If while one of the prisms remains at rest, the other be revolved on its axis, the continual alteration of the colours will afford a pleasing variety; which may be further increased by turning the prism round in different directions. Fig. 5.

When the prisms are so placed that the two spectrums become coincident in an inverted order of their colours, the red end of one falling on the violet end of the other; if they be then viewed through a third prism DH, held parallel to their length, they will no longer appear coincident, but in the form of two distinct spectrums, *pt* and *nm* (fig. 6.), crossing one another in the middle, like the letter X: the red of one spectrum and the violet of the other, which were coincident at NM, being parted from each other by a greater refraction of the violet to *p* and *m*, than that of the red to *n* and *t*.

This experiment may be further diversified by adding two other prisms, that shall form a spectrum in the same line, and contiguous in the other; by which not only the variety of figures, but the vicissitude of colours, will be considerably augmented.

### *The diatonic scale of colours.*

THE illustrious Newton, in the course of his investigations of the properties of light, discovered that the length of the spaces which the seven primary colours possess in the spectrum, exactly corresponds to those of chords that sound the seven notes in the diatonic scale of music. As is evident by the following experiment.

On a paper in a dark chamber, let a ray of light be largely refracted into the spectrum AFTMGP, and mark the precise boundaries of the several colours, as *a*, *b*, *c*, *&c.* Draw lines from those points perpendicular to the opposite side, and you will find that the spaces M *r f* F, by which the red is bounded: *r g e f*, by which the orange is bounded; *q p e d*, by which the yellow is bounded, *&c.* will be in exact proportion Fig. 7.

to

to the divisions of a musical chord for the notes of an octave; that is, as the intervals of these numbers 1, $\frac{8}{9}$, $\frac{5}{6}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{9}{16}$, $\frac{1}{2}$.

### IX. *Colorific music.*

FATHER CASTEL, a Frenchman, in a curius book he has published on chromatics, supposes the note *ut* to answer to blue in the prismatic colours; the note *re* to yellow, and *mi* to red. The other tones he refers to the intermediate colours; from whence he constructs the following gamut of colorific music:

| | |
|---|---|
| Ut | Blue |
| Ut sharp | Sea-green |
| Re | Bright green |
| Re sharp. | Olive green |
| Mi | Yellow |
| Fa | Aurora |
| Fa sharp | Orange |
| Sol | Red |
| Sol sharp | Crimson |
| La | Violet |
| La sharp | Blue Violet |
| Si | Sky blue |
| Ut. | Blue |

This gamut, according to his plan, is to be continued in the same manner for the following octave; except that the colours are to be more vivid.

He supposes that these colours, by striking the eye in the same succession as the sounds (to which he makes them analogous) do the ear, and in the same order of time, they will produce a correspondent sensation of pleasure in the mind. It is on these general principles, which F. Castel has dilucidated in his treatise, that he has endeavoured, though with little success, to establish his ocular harpsichord.

The construction of this instrument, as here explained, will show that the effects produced by colours by no means answer those of sounds, and that the principal relation there is between them consists in the duration of the time that they respectively affect the enes.

Fig. 8. Between two circles of pasteboard, of ten inches diameter, AB and CD, inclose a hollow pasteboard cylinder E, 18 inches long. Divide this cylinder into spaces half an inch wide, by a spiral line that runs round it from top to bottom, and divide its surface into six equal parts by parallel lines drawn between its two extremities; as is expressed in the figure.

Let the circle AB, at top, be open; and let that at bottom, CD, be closed, and supported by an axis or screw, of half an inch diameter, which must turn freely in a nut placed at the bottom of a box we shall presently describe. To the axis just mentioned adjust a wooden wheel G, of two inches and a half in diameter, and that has 12 or 15 teeth, which take the endless screw H. Let this cylinder be inclosed in a box ILMN (fig. 9.) whose base is square, and at whose bottom there is a nut in which the axis F turns. Observe that the endless screw H should come out of the box, that it may receive the handle O, by which the cylinder is to be turned.

This box being closed all round, place over it a tin covering A, which must be perforated in different parts; from this cover there must hang three or four lights, so placed that they may strongly illumine the inside of the cylinder. In one side of this box (which should be covered with pasteboard) cut eight apertures, *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, of half an inch wide, and $\frac{1}{3}$ of an inch high; they must be directly over each other, and the distance between them must be exactly two inches. It is by these openings, which here correspond to the musical notes, that the various colours analogous to them are to appear; and which being placed on the pasteboard cylinder, as we have shown, are reflected by means of the lights placed within it. Fig. 9.

It is easy to conceive, that when the handle O is turned, the cylinder in consequence rising half an inch, if it be turned five times round, it will successively show, at the openings made in the side of the box, all those that are in the cylinder itself, and which are ranged according to the direction of the inclined lines drawn on it. It is therefore according to the duration of the notes which are to be expressed, that the apertures on the cylinder are to be cut. Observe, that the space between two of the parallel lines drawn vertically on the cylinder, is equal to one measure of time; therefore, for every turn of the cylinder, there are six measures, and thirty measures for the air that is to be played by this instrument.

The several apertures being made in the side of the cylinder, in conformity to the notes of the tune that is to be expressed, they are to be covered with double pieces of very thin paper, painted on both sides with the colours that are to represent the musical notes.

This experiment might be executed in a different manner, and with a much greater extent; but as the entertainment would not equal the trouble and expence, we have thought it sufficient to give the above piece, by which the reader will be enabled to judge how far the analogy supposed by F. Castel really exists.

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CHRONIC, or CHRONICAL, among physicians, an appellation given to diseases that continue a long time; in contradistinction to those that soon terminate and are called *acute*.

CHRONICLE, in matters of literature, a species or kind of history disposed according to the order of time, and agreeing in most respects with annals. See ANNALS.

*Parian* CHRONICLE. See *ARUNDELIAN Marbles*. Since that article was printed, in which an abstract was given of Mr Robertson's doubts and observations respecting the authenticity of the Parian Chronicle, one or two publications have since appeared in answer, but none of them calculated to remove the objections or materially to affect the arguments that had been stated with so much learning and ingenuity against it. The following strictures, however, with which the Monthly Reviewers have concluded their critique of Mr Robertson's performance, seem to merit consideration.

Chronicle. Monthly Review, Jan. 1787.

On Objection I. *That the characters have no certain or unequivocal marks of antiquity*, the Reviewers remark, that this seems rather to be an answer to a defender of the inscription, than an objection. If a zealous partizan of the marble should appeal to its characters and orthography, as decisive proofs of its being genuine, it would be proper enough to answer, that these circumstances afford no certain criterion of authenticity. But in this word *certain* sculks an unlucky ambiguity. If it means demonstrative, it must be allowed that no inscription can be proved to be certainly genuine from these appearances; but if it means no more than highly probable, many inscriptions possess sufficient internal evidence to give their claims this degree of certainty. The true question is, Has not the Parian Chronicle every mark of antiquity that can be expected in a monument claiming the age of 2000 years? The letters Γ and Ξ are, by Mr R's own confession, such as occur in genuine inscriptions; and to say in answer, that an impostor might copy the forms of these letters from other inscriptions, is already to suppose the inscription forged, before it is rendered probable by argument. The learned author of the Dissertation seems to betray some doubt of his own conclusion; for he adds, p. 56. "that the antiquity of an inscription can never be proved by the mere form of the letters, because the most ancient characters are as easily counterfeited as the modern." But this objection is equally applicable to all other ancient inscriptions; and is not to the purpose, if the present inscription has any peculiar marks of imposture in its characters and orthography. "The characters do not resemble the Sigean, the Nemean, or the Delian inscriptions." Mr R. answers this objection himself, by adding, "which are supposed to be of a more ancient date." The opposite reason to this will be a sufficient answer to the other objection, "that they do not resemble the Farnesian pillars or the Alexandrian MS." If "they differ in many respects from the Marmor Sandvicense," they may be presumed to agree in many. "They seem to resemble, more than any other, the alphabet taken by Montfaucon from the Marmor Cyzicenum." Thus it appears that the Parian Chronicle most nearly resembles the two inscriptions, to whose age it most nearly approaches.

When Mr R. adds, that the letters "are such as an ordinary stone-cutter would probably make, if he were employed to engrave a Greek inscription, according to the alphabet now in use," he must be understood *cum grano salis*. The engraver of a fac simile generally omits some nice and minute touches in taking his copy; but, even with this abatement, we dare appeal to any adept in Greek calligraphy, whether the specimen facing p. 56, will justify our author's observation? "The small letters (ο, Θ, Ω) intermixed among the larger, have an air of affectation and artifice." Then has the greater part of ancient inscriptions an air of affectation and artifice. For the ο is perpetually engraved in this diminutive size; and Ω being of a kindred sound, and Θ of a kindred shape, how can we wonder that all three should be represented of the same magnitude? In the inscription which immediately follows the marble in Dr Chandler's edition, N° XXIV. these very three letters are never so large as the rest, and often much smaller; of which there are instances in the three first lines. See also two medals in the second part of Dorville's Sicula, Tab. XVI. Numb. 7, 9.

"From the archaisms, such as εγ Λυκωρειας, εγ Κυβελοις, εμ Παρωι, &c. &c. no conclusion can be drawn in favour of the authenticity of the inscription." Yet surely every thing common to it with other inscriptions, confessedly genuine, creates a reasonable presumption in its favour. "But what reason could there be for these archaisms in the Parian Chronicle? We do not usually find them in Greek writers of the same age, or even of a more early date." The reason is, according to our opinion, that such archaisms were then in use: this we know from other inscriptions, in which such archaisms (or, as our author afterward calls them, barbarisms) are frequent. Nothing can be inferred from the Greek writers, unless we had their autographs. The present system of orthography in our printed Greek books is out of the question. Again, "The inscription sometimes adopts and sometimes neglects these archaisms, as in lines 4, 12, 27, 52, 63, 67." This inconsistency either is no valid objection, or if it be valid, will demolish not only almost every other inscription, but almost every writing whatsoever. For example, in the inscription just quoted, N° XXIV. we find τεΝ βασιλεα, l. 20. and σταΜ πεμπτηι, 34. A little farther, N° XXVI. l. 31. we have εΓ Μαγνησιας, 57. 73. 81. εΚ Μαγνησιας, and 106. 108. εΚΓ Μαγνησιας. The Corcyrean inscription (Montfaucon, Diar. Ital. p. 420) promiscuously uses εΚδανειζομαι and εΓδανειζομαι. In English, who is surprised to find *has* and *hath*, *a hand* and *an hand*, *a useful* and *an useful*, in the works of the same author? We could produce instances of this inaccuracy from the same page, nay from the same sentence.

"The authenticity of those inscriptions, in which these archaisms appear, must be established, before they can be produced in opposition to the present argument." This is, we cannot help thinking, rather too severe a restriction. If no inscription may be quoted before it be proved genuine, the learned author of the Dissertation need not be afraid of being confuted; for nobody will engage with him on such conditions. Perhaps the reverse of the rule will be thought more equitable; that every inscription be allowed to be genuine, till its authenticity be rendered doubtful by probable arguments. We will conclude this head with two short observations. In Selden's copy, l. 26. was written ΠΟΗΣΙΝ, which the later editors have altered to ΠΟΙΗΣΙΝ, but without reason, the other being the more ancient way of writing, common in MSS. and sometimes found on inscriptions. (See G. Koen's Notes on *Gregorius de Dialectis*, p. 30.) In l. 83. the marble has Καλλεου, for which Palmer wished to substitute Καλλιου. Dr Taylor refutes him from the *Marmor Sandvicense*, observing at the same time, that this orthography occurs in no other place whatever except in these two monuments. Is it likely that two engravers should by chance coincide in the same mistake, or that the forger of the Parian Chronicle (if it be forged) should have seen the *Marmor Sandvicense*, and taken notice of this peculiarity with the intention of afterward employing it in the fabrication of an imposture?

The

Chronicle.

The Reviewers next proceed to consider, but more briefly, the other objections.

II. *It is not probable that the Chronicle was engraved for private use.* 1. *Because it was such an expence, as few learned Greeks were able to afford.* If only a *few* were able to afford it, some one of those *few* might be willing to incur it. But let Mr R. consider how likely it is that a modern, and probably a needy Greek, should be more able to afford it in the last century, than a learned Greek 2000 years ago! 2. *A manuscript is more readily circulated.* Do men never prefer cumbrous splendor to cheapness and convenience? And if this composition, instead of being engraved on marble, had been committed to parchment, would it have had a better chance of coming down to the present age? Such a flying sheet would soon be lost; or, if a copy had, by miracle, been preserved to us, the objections to its being genuine would be more plausible than any that have been urged against the inscription. What Mr R. says about the errors to which an inscription is liable, &c. will only prove that chronological inscriptions ought not to be engraved; but not that they never were. We allow that the *common* method of writing in the reign of Ptolemy Philadelphus was NOT on STONES. But it was common enough to occur to the mind of any person who wished to leave behind him a memorial at once of his learning and magnificence.

III. This objection, *that the marble does not appear to be engraved by public authority*, we shall readily admit, though Bentley (Diss. on Phalaris, p. 251.) leans to the contrary opinion. In explaining this objection, the learned dissertator observes, that though the expression, αρχοντος εμ Παρωι, would lead us to suppose that the inscription related to Paros, not a single circumstance in the history of that island is mentioned. But this expression only shows that the author was an inhabitant of Paros, and intended to give his readers a clue, or *parapegma*, by the aid of which they might adjust the general chronology of Greece to the dates of their own history. "It is as absurd as would be a marble in Jamaica containing the revolutions of England." We see no absurdity in supposing a book to be written in Jamaica containing the revolutions of England. The natives of Paros were not uninterested in events relating to the general history of Greece, particularly of Athens; and how can we tell whither the author were an *inquilinus* or a native of the island; whether he thought it a place beneath his care; or whether he had devoted a separate inscription to the chronology of Paros?

IV. *It has been frequently observed, that the earlier periods of the Grecian history are involved in darkness and confusion.* Granted. It follows then, that "an author who should attempt to settle the dates of the earlier periods would frequently contradict preceding, and be contradicted by subsequent, writers: that he would naturally fall into mistakes: and at best could only hope to adopt the most probable system. But the difficulty of the task, or the impossibility of success, are not sufficient to prove that no man has been rash or mad enough to make the attempt." On the contrary, we know that many have made it. What a number of discordant opinions has Mr R. himself given us from the ancients concerning the age of Homer? This consideration will in part obviate another objection, that the Parian Chronicle does not agree with any ancient author. For if the ancients contradict one another, how could it follow more than one of them? and why might not the author, without any imputation of ignorance or rashness, sometimes depart from them all? If indeed he disagrees with them when they are unanimous, it might furnish matter for suspicion; though even this would be far from a decisive argument, unless the ancients were so extremely unlike the moderns, as never to be fond of singular and paradoxical positions.

V. *This Chronicle is not once mentioned by any writer of antiquity.* How many of those inscriptions, which are preserved to the present day, are mentioned by classical authors? Verrius Flaccus composed a Roman kalendar, which, as a monument of his learning and industry, was engraved on marble, and fixed in the most public part of Preneste. Fragments of this very kalendar were lately dug up at Preneste, and have been published by a learned Italian. Now, if the passage of Suetonius, which informs us of this circumstance, had been lost, would the silence of the Latin writers prove that the fragments were not genuine remains of antiquity? It may be said that the cases are not parallel; for not a single author mentions the Parian Chronicle, whereas Suetonius does mention Verrius's Roman kalendar. To this we answer, It is dangerous to deny the authenticity of any monument on the slender probability of its being casually mentioned by a single author. We shall also observe, that this fact of the Hemicyclium of Verrius will answer some part of the Dissertator's second objection: "The Parian Chronicle is not an inscription that might have been concealed in a private library." Why not? it is of no extraordinary bulk; and might formerly have been concealed in a private library, or in a private room, with as much ease as many inscriptions are now concealed in very narrow space. But unless the monument were placed in some conspicuous part of the island, and obtruded itself on the notice of every traveller, the wonder will in great measure cease why it is never quoted by the ancients. Of the nine authors named in p. 109, had any one ever visited Paros? If Pausanias had travelled thither, and published his description of the place, we might perhaps expect to find some mention of this marble in so curious and inquisitive a writer. But though the inscription existed, and were famous at Paros, there seems no necessity for any of the authors whose works are still extant to have known or recorded it. If there be, let this learned antagonist point out the place where this mention ought to have been made. If any persons were bound by a stronger obligation than others to speak of the Parian inscription, they must be the professed chronologers; but alas! we have not the entire works of so much as a single ancient chronologer: It is therefore impossible to determine whether this Chronicle were quoted by any ancient. And supposing it had been seen by some ancient, whose writings still remain, why should he make particular mention of it? Many authors, as we know from their remains, very freely copied their predecessors without naming them. Others, finding only a collection of bare events in the inscription, without historical proofs or reasons, might entirely neglect it, as deserving no credit. Mr R. seems to lay much stress on the precise, exact, and particular spe-

ſpecification of the events, p. 109. But he ought to reflect, that this abrupt and poſitive method of ſpeaking is not only uſual, but neceſſary, in ſuch ſhort ſyſtems of chronology as the marble contains, where events only, and their dates, are ſet down, unaccompanied by any examination of evidences for and againſt, without ſtating any computation of probabilities, or deduction of reaſons. When therefore a chronological writer had undertaken to reduce the general hiſtory of Greece into a regular and conſiſtent ſyſtem, admitting that he was acquainted with this inſcription, what grounds have we to believe that he would ſay any thing about it? Either his ſyſtem coincided with the Chronicle or not: if it coincided, he would very probably diſdain to prop his own opinions with the unſupported aſſertions of another man, who, as far as he knew was not better informed than himſelf. On the other hand, if he differed from the authority of the marble, he might think it a ſuperfluous exertion of complaiſance, to refute, by formal demonſtration, a writer who had choſen to give no reaſons for his own opinion. We ſhall paſs hence to

Objection VII. With reſpect to the parachroniſms that Mr R. produces, we ſhall without heſitation grant, that the author of the inſcription may have committed ſome miſtakes in the chronology, as perhaps concerning Phidon, whom he ſeems to have confounded with another of the ſame name, &c. But theſe miſtakes will not conclude againſt the antiquity of the inſcription, unleſs we at the ſame time reject many of the principal Greek and Roman writers, who have been convicted of ſimilar errors. We return therefore to

Objection VI. *Some of the facts ſeem to have been taken from authors of a later date.* We have endeavoured impartially to examine and compare the paſſages quoted in proof of this objection; but we are obliged to confeſs, that we do not perceive the fainteſt traces of theft or imitation. One example only deſerves to be excepted; to which we ſhall therefore pay particular attention.

"The names of ſix; and, if the lacunæ are properly ſupplied, the names of twelve cities, appear to have been engraved on the marble, exactly as we find them in Ælian's Various Hiſtory. But there is not any imaginable reaſon for this particular arrangement. It does not correſpond with the time of their foundation, with their ſituation in Ionia, with their relative importance, or with the order in which they are placed by other eminent hiſtorians."

The chance of ſix names, ſays Mr R. being placed by two authors in the ſame order, is as 1 to 720; of 12, as 1 to 479,001,600. "It is therefore utterly improbable that theſe names would have been placed in this order on the marble, if the author of the inſcription had not tranſcribed them from the hiſtorian."

On this argument we ſhall obſerve, 1. That the very contrary concluſion might poſſibly be juſt, that the hiſtorian tranſcribed from the inſcription. Yet we ſhall grant that in the preſent caſe this is improbable, eſpecially if the author of the Various Hiſtory be the ſame Ælian, who, according to Philoſtratus, Vit. Sophiſt. II. 31. never quitted Italy in his life. But an intermediate writer might have copied the marble, and Ælian might have been indebted to him. 2dly, We ſee no reaſon to allow, that the *lacunæ* are properly ſupplied. Suppoſe we ſhould aſſert, that the names ſtood originally thus: Miletus, Epheſus, Erythræ, Clazomenæ, Lebedos, Chios, Phocæa, Colophon, Myus, Priene, Samos, Teos. In this arrangement, only four names would be together in the ſame order with Ælian; and from theſe Miletus muſt be excepted, becauſe there is an obvious reaſon for mentioning that city firſt. Three only will then remain; and ſurely that is too ſlight a reſemblance to be conſtrued into an imitation. For Pauſanias and Paterculus, quoted by our author, p. 154, have both enumerated the ſame twelve cities, and both agree in placing the five laſt in the ſame order; nay, the ſix laſt, if Voſſius's conjecture that TEUM ought to be inſerted in Paterculus after Myum TEM be as true as it is plauſible. But who imagines that Pauſanias had either opportunity or inclination to copy Paterculus? 3dly, Allowing that the names were engraved on the marble exactly in the order that Ælian has choſen, is there no way of ſolving the phenomenon but by ſuppoſing that one borrowed from the other? Seven authors at leaſt (Mr R ſeems to ſay more, p. 154, 5.) mention the colonization of the ſame cities: how many authors now loſt may we reaſonably conjecture to have done the ſame? If therefore the compoſer of the Chronicle and Ælian lighted on the ſame author, the former would probably preſerve the ſame arrangement that he found, becauſe in tranſcribing a liſt of names, he could have no temptation to deviate; and the latter would certainly adhere faithfully to his original, becauſe he is a notorious and ſervile plagiariſt. Mr R. indeed thinks, p. 158, that if a ſucceeding writer had borrowed the words of the inſcription, he would not have ſuppreſſed the name of the author. This opinion muſt fall to the ground, if it be ſhown that Ælian was accuſtomed to ſuppreſs the names of the authors to whom he was obliged. Ælian has given a liſt of fourteen celebrated gluttons; and, elſewhere, another of twenty-eight drunkards (from which, by the way, it appears, that people were apt to eat and drink rather too freely in ancient as well as modern times); and both theſe liſts contain exactly the ſame names in the ſame order with Atheneus. Now, it is obſervable, that fourteen names may be tranſpoſed 87,178,291,200 different ways, and that twenty-eight names admit of 304,888,344,611,713,860,501,504,000,000 different tranſpoſitions, &c. &c. Ælian therefore tranſcribed them from Atheneus? yet Ælian never mentions Atheneus in his Various Hiſtory. So that whether Ælian copied from the marble, or only drew from a common ſource, he might, and very probably would, conceal his authority.

VIII. *The hiſtory of the diſcovery of the Marbles is obſcure and unſatisfactory.*

In p. 169, it is ſaid to be "related with ſuſpicious circumſtances, and without any of thoſe clear and unequivocal evidences which always diſcriminate truth from falſehood." The queſtion then is finally decided. If the inſcription has not any of thoſe evidences which truth always poſſeſſes, and which falſehood always wants, it is moſt certainly forged. The learned diſſertator ſeems for a moment to have forgotten the modeſt character of a *doubter*, and to perſonate the dogmatiſt. But waving this, we ſhall add, that, as far as we can ſee, no

Chronicle. no appearance of fraud is discoverable in any part of the transaction. The history of many inscriptions is related in a manner equally unsatisfactory; and if it could be clearly proved that the marble was dup up at Paros, what would be easier for a critic, who is determined at any rate to object, than to say, that it was buried there in order to be afterward dug up? If the person who brought this treasure to light had been charged on the spot with forging it, or concurring in the forgery, and had then refused to produce the external evidences of its authenticity, we should have a right to question, or perhaps to deny, that it was genuine. But no such objection having been made or hinted, at the original time of its discovery, it is unreasonable to require such testimony as it is now impossible to obtain. "There is nothing said of it in Sir T. Roe's negotiations." What is the inference? That Sir Thomas knew nothing of it, or believed it to be spurious, or forged it, or was privy to the forgery? Surely nothing of this kind can be pretended. But let our author account for the circumstance if he can. To us it seems of no consequence on either side. "Peiresc made no effort to recover this precious relic; and from his composure he seems to have entertained some secret suspicions of its authenticity." Peiresc would have had no chance of recovering it after it was in the possession of lord Arundel's agents. He was either a real or a pretended patron of letters; and it became him to affect to be pleased that the inscription had come into England, and was illustrated by his learned friend Selden. John F. Gronovius had, with great labour and expence, collated Anna Comnena's Alexiades, and intended to publish them. While he was waiting for some other collations, they were intercepted, and the work was published by another. As soon as Gronovius heard this unpleasant news, he answered, that learned men were engaged in a common cause; that if one prevented another in any publication, he ought rather to be thanked for lightening the burden, than blamed for interfering. But who would conclude from this answer, that Gronovius thought the Alexiades spurious, or not worthy of any regard?

Mr R. calculates, that the venders of the marble received 2 o pieces. But here again we are left in the dark, unless we knew the precise value of these pieces. Perhaps they might be equal to an hundred of our pounds, perhaps only to fifty. Besides, as they at first bargained with Samson Pieresc's supposed Jew agent for fifty pieces only, they could not have forged the inscription with the clear prospect of receiving more; neither does it appear that they were paid by Samson. It is fully as reasonable to suppose fraud on the one side as on the other; and if Samson, after having the marble in his possession, refused or delayed to pay the sum stipulated, he might, in consequence of such refusal or delay, be thrown into prison, and might, in revenge, damage the marble before the owners could recover it. We own this account of ours to be a romance; but it is lawful to combat romance with romance.

IX. *The world has been frequently imposed upon by spurious books and inscriptions; and therefore we should be extremely cautious with regard to what we receive under the venerable name of antiquity.*

Much truth is observable in this remark. But the danger lies in applying such general apophthegms to particular cases. In the first place, it must be observed, that no forged books will exactly suit Mr R.'s purpose, but such as pretend to be the author's own hand-writing; nor any inscriptions, but such as are still extant on the original materials, or such as were known to be extant at the time of their pretended discovery. Let the argument be bounded by these limits, and the number of forgeries will be very much reduced. We are not in possession of Cyriacus Anconitanus's book; but if we were governed by authority, we should think that the testimony of Reinesius in his favour greatly overbalances all that Augustinus has said to his prejudice. The opinion of Reinesius is of the more weight, because he suspects Ursinus of publishing counterfeit monuments. We likewise find the most eminent critics of the present age quoting Cyriacus without suspicion (*Vid.* Ruhnken. in Timæi Lex. Plat. p. 10. apud Ceon, ad Gregor. p. 140.) The doctrine advanced in the citation from Hardouin is exactly conformable to that writer's usual paradoxes. He wanted to destroy the credit of all the Greek and Latin writers. But inscriptions hung like a millstone about the neck of his project. He therefore resolved to make sure work, and to deny the genuineness of as many as he saw convenient: to effect which purpose, he intrenches himself in a general accusation. If the author of the dissertation had quoted a few more paragraphs from Hardouin, in which he endeavours, after his manner, to show the forgery of some inscriptions, he would at once have administered the poison and the antidote. But to the reveries of that learned madman, respecting Greek supposititious compositions of this nature, we shall content ourselves with opposing the sentiments of a modern critic, whose judgment on the subject of spurious inscriptions will not be disputed. Maffei, in the introduction to the third book, c. 1. p. 51. of his admirable, though unfinished, work *de Arte Critica Lapidaria*, uses these words: *Inscriptionum Græce loquentium commentitias, si cum Latinis comparemus, deprehendi paucas; neque enim ullum omnino est, in tanta debacchantium falsariorum libidine, monumenti genus, in quod ii sibi minus licere putaverint. Argumenta est, paucissimas usque in hanc diem ab eruditis viris, et in hoc literarum genere plurimum versatis rejectas esse, falsique damnatas.*

*Books of* CHRONICLES, a canonical writing of the Old Testament. It is uncertain which were written first, *The Books of Kings*, or *The Chronicles*, since they each refer to the other. However it be, the latter is often more full and comprehensive than the former. Whence the Greek interpreters call these two books Παραλειπομενα, *Supplements*, *Additions*, because they contain some circumstances which are omitted in the other historical books. The Jews make but one book of the Chronicles, under the title of *Dibre-Haiamim*, i. e. *Journals or Annals.* Ezra is generally believed to be the author of these books. It is certain they were written after the end of the Babylonish captivity and the first year of the reign of Cyrus, of whom mention is made in the last chapter of the second book.

The *Chronicles*, or *Paraleipomena*, are an abridgement

Chronicles, Chronology. ment of all the sacred history, from the beginning of the Jewish nation to their first return from the captivity taken out of those books of the Bible which we still have, and out of other annals which the author had then by him. The design of the writer was to give the Jews a series of their history. The first book relates to the rise and propagation of the people of Israel from Adam, and gives a punctual and exact account of the reign of David. The second book sets down the progress and end of the kingdom of Judah, to the very year of their return from the Babylonish captivity.

Chronogram, Chronology. CHRONOGRAM, a species of false wit, consisting in this, that a certain date or epocha is expressed by numeral letters of one or more verses; such is that which makes the motto of a medal struck by Gustavus Adolphus in 1632:

ChrIstVs DVX; ergo trIVMphVs.

# CHRONOLOGY,

TREATS of time, the method of measuring its parts, and adapting these, when distinguished by proper marks and characters, to past transactions, for the illustration of history. This science therefore consists of two parts. The first treats of the proper measurement of time, and the adjustment of its several divisions; the second of fixing the dates of the various events recorded in history, and ranging them, according to the several divisions of time, in the order in which they happened.

1 How divided.

2 Chronology unknown to the ancients.

Chronology, comparatively speaking, is but of modern date. The ancient poets appear to have been entirely unacquainted with it; and Homer, the most celebrated of them all, mentions nothing like a formal kalendar in any part of his writings. In the most early periods, the only measurement of time was by the seasons, the revolutions of the sun and moon; and many ages must have elapsed before the mode of computation by dating events came into general use. Several centuries intervened between the era of the olympic games and the first historians; and several more between these and the first authors of chronology. When time first began to be reckoned, we find its measures very indeterminate. The succession of Juno's priestesses at Argos served Hellanicus for the regulation of his narrative; while Ephorus reckoned his matters by generations. Even in the history of Herodotus and Thucydides, we find no regular date for the events recorded; nor was there any attempt to establish a fixed era, until the time of Ptolemy Philadelphus, who attempted it by comparing and correcting the dates of the olympiads, the kings of Sparta, and the succession of the priestesses of Juno at Argos. Eratosthenes and Apollodorus digested the events recorded by them according to the succession of the olympiads and of the Spartan kings.

3 Inaccurate methods of computing time at first made use of.

The uncertainty of the measures of time in the most early periods renders the histories of those times equally uncertain; and even after the invention of dates and eras, we find the ancient historians very inattentive to them, and inaccurate in their computations. Frequently their eras and years were reckoned differently without their being sensible of it, or at least without giving the reader any information concerning it; a circumstance which has rendered the fragments of their works now remaining of very little use to posterity. The Chaldean and Egyptian writers are generally acknowledged to be fabulous; and Strabo acquaints us, that Diodorus Siculus, and the other early historians of Greece, were ill informed and credulous. Hence the disagreement among the ancient historians, and the extreme confusion and contradiction we meet with on comparing their works. Hellanicus and Acesilaus disagreed about their genealogies; the latter rejected the traditions of Hesiod. Timæus accused Ephorus of falsehood, and the rest of the world accused Timæus. The most fabulous legends were imposed on the world by Herodotus; and even Thucydides and Diodorus, generally accounted able historians, have been convicted of error. The chronology of the Latins is still more uncertain. The records of the Romans were destroyed by the Gauls; and Fabius Pictor, the most ancient of their historians, was obliged to borrow the greatest part of his information from the Greeks. In other European nations the chronology is still more imperfect and of a later date; and even in modern times, a considerable degree of confusion and inaccuracy has arisen from want of attention in the historians to ascertain the dates and epochs with precision.

4 Ancient historians not to be credited.

From these observations it is obvious how necessary a proper system of chronology must be for the right understanding of history, and likewise how very difficult it must be to establish such a system. In this, however, several learned men have excelled, particularly Julius Africanus, Eusebius of Cæsarea, George Cyncelle, John of Antioch, Dennis, Petau, Cluviar, Calvisius, Usher, Simson Marsham, Blair, and Playfair. It is founded, 1. On astronomical observations, particularly of the eclipses of the sun and moon, combined with the calculations of the eras and years of different nations. 2. The testimonies of credible authors. 3. Those epochs in history which are so well attested and determined, that they have never been controverted. 4. Ancient medals, coins, monuments, and inscriptions. None of these, however, can be sufficiently intelligible without an explanation of the first part, which, we have already observed, considers the divisions of time, and of which therefore we shall treat in the first place.

5 Utility of chronology, list of chronologers, &c.

The most obvious division of time is derived from the apparent revolutions of the celestial bodies, particularly of the sun, which by the vicissitudes of day and night becomes evident to the most barbarous and ignorant nations. In strict propriety of speech the word *day* signifies only that portion of time during which the sun diffuses light on any part of the earth; but in the most comprehensive sense, it includes the night also, and is called by chronologers a *civil* day; by astronomers a *natural*, and sometimes an *artificial*, day.

6 Of the division of time into days.

By

7 Civil, solar, &c. days defined.

By a civil day is meant the interval betwixt the sun's departure from any given point in the heavens and next return to the same, with as much more as answers to its diurnal motion eastward, which is at the rate of 59 minutes and 8 seconds of a degree, or 3 minutes and 57 seconds of time. It is also called a *solar* day, and is longer than a *sidereal* one, insomuch that, if the former be divided into 24 equal parts or hours, the latter will consist only of 23 hours 56 minutes. The apparent inequality of the sun's motion, likewise, arising from the obliquity of the ecliptic, produces another inequality in the length of the days: and hence the difference betwixt real and apparent time, so that the apparent motion of the sun cannot always be a true measure of duration. Those inequalities, however, are capable of being reduced to a general standard, which furnishes an exact measure throughout the year; whence arises the difference between mean and apparent time, as is explained under the article ASTRONOMY.

8 Different ways of computing the beginning of the day.

There have been very considerable differences among nations with regard to the beginning and ending of their days. The beginning of the day was counted from sunrise by the Babylonians, Syrians, Persians, and Indians. The civil day of the Jews was begun from sunrise, and their sacred one from sunset; the latter mode of computation being followed by the Athenians, Arabs, ancient Gauls, and other European nations. According to some, the Egyptians began their day at sunset, while others are of opinion that they computed from noon or from sunrise; and Pliny informs us that they computed their civil day from one midnight to another. It is probable, however, that they had different modes of computation in different provinces or cities. The Ausonians, the most ancient inhabitants of Italy, computed the day from midnight; and the astronomers of Cathay and Oighur in the East Indies reckoned in the same manner. This mode of computation was adopted by Hipparchus, Copernicus, and other astronomers, and is now in common use among ourselves. The *astronomical* day, however, as it is called, on account of its being used in astronomical calculations, commences at noon, and ends at the same time the following day. The Mahometans reckon from one twilight to another.

9 Strange method of computation in Italy.

In Italy, the civil day commences at some indeterminate point after sunset: whence the time of noon varies with the season of the year. At the summer solstice, the clock strikes 16 at noon, and 19 at the time of the winter solstice. Thus also the length of each day differs by several minutes from that immediately preceding or following it. This variation requires a considerable difficulty in adjusting their time by clocks. It is accomplished, however, by a sudden movement which corrects the difference when it amounts to a quarter of an hour; and this it does sometimes at the end of eight days, sometimes at the end of 15, and sometimes at the end of 40. Information of all this is given by a printed kalendar, which announces, that from the 16th of February, for instance, to the 24th, it will be noon at a quarter past 18; from the 24th of February to the 6th of March, it will be noon at 18 o'clock precisely; from the first of June to the 13th of July, the hour of noon will be at 16 o'clock; on the 13th of July it will be at half an hour after 16; and so on throughout the different months of the year. This absurd method of measuring the day continues, notwithstanding several attempts to suppress it, throughout the whole of Italy, a few provinces only excepted.

10 Various subdivisions of the day.

The subdivisions of the day have not been less various than the computations of the day itself. The most obvious division, and which could at no time, nor in no age, be mistaken, was that of morning and evening. In process of time the two intermediate points of noon and midnight were determined; and this division into quarters was in use long before the invention of hours.

From this subdivision probably arose the method used by the Jews and Romans of dividing the day and night into four vigils or watches. The first began at sun-rising, or six in the morning; the second at nine; the third at twelve; and the fourth at three in the afternoon. In like manner the night was divided into four parts; the first beginning at six in the evening, the second at nine, the third at twelve, and the fourth at three in the morning. The first of these divisions was called by the Jews the *third* hour of the day; the second the *sixth*; the third the *ninth*; and the fourth the *twelfth*, and sometimes the *eleventh*. Another division in use, not only among the nations abovementioned, but the Greeks also, was that which reckoned the first quarter from sunset to midnight; the second from midnight to sunrise; the third, or morning watch, from morning to noon; and the fourth from noon to sunset.

11 Inventions of hours uncertain.

It is uncertain at what time the more minute subdivision of the day into hours first commenced. It does not appear from the writings of Moses that he was acquainted with it, as he mentions only the morning, mid-day, evening, and sunset. Hence we may conclude, that the Egyptians at that time knew nothing of it, as Moses was well skilled in their learning. According to Herodotus, the Greeks received the knowledge of the twelve hours of the day from the Babylonians. It is probable, however, that the division was actually known and in use before the name *hour* was applied to it; as Censorinus informs us that the term was not made use of in Rome for 300 years after its foundation; nor was it known at the time the twelve tables were constructed.

The eastern nations divide the day and night in a very singular manner; the origin of which is not easily discovered. The Chinese have five watches in the night, which are announced by a certain number of strokes on a bell or drum. They begin by giving one stroke, which is answered by another; and this is repeated at the distance of a minute or two, until the second watch begin, which is announced by two strokes; and so on throughout the rest of the watches. By the ancient Tartars, Indians, and Persians, the day was divided into eight parts, each of which contained seven hours and a half.

12 Method of computation on the coast of Malabar.

The Indians on the coast of Malabar divide the day into six parts, called *najika*; each of these six parts is subdivided into 60 others, called *venaigas*; the venaiga into 60 *birpes*; the birpe into 10 *kenikans*; the kenikan into four *mattires*; the mattire into eight *kannimas* or *caignodes*; which divisions, according to our mode of computation, stand as follows.

Najika,

| | | | | | |
|---|---|---|---|---|---|
| Najika, | Venaiga, | Birpe, | Kenikan, | Mattire, | Caignode. |
| 24 min. | 24 sec. | 4 sec. | $\frac{2}{5}$ sec. | $\frac{1}{10}$ sec. | $\frac{1}{80}$ sec. |

The day of the Chinese is begun at midnight, and ends with the midnight following. It is divided into twelve hours, each distinguished by a particular name and figure. They also divide the natural day into 100 parts, and each of these into 100 minutes; so that the whole contains 10,000 minutes. In the northern parts of Europe, where only two seasons are reckoned in the year, the divisions of the day and night are considerably larger than with us. In Iceland the 24 hours are divided into eight parts; the first of which commences at three in the morning; the second at five; the third at half an hour after eight; the fourth at eleven; the fifth at three in the afternoon; the sixth at six in the evening; the seventh, at eight, and the last at midnight. In the eastern part of Turkestan, the day is divided into twelve equal parts, each of which is distinguished by the name of some animal. These are subdivided into eight *keh*; so that the whole 24 hours contain 96 *keh*.

13 Divisions of the hour into minutes, &c.

The modern divisions of the hour in use among us are into minutes, seconds, thirds, fourths, &c. each being a sixtieth part of the former subdivision. By the Chaldæans, Jews, and Arabians, the hour is divided into 1080 scruples; so that one hour contains 60 minutes, and one minute 18 scruples. The ancient Persians and Arabs were likewise acquainted with this division; but the Jews are so fond of it, that they pretend to have received it in a supernatural manner. "Issachar (say they) ascended into heaven, and brought from thence 1080 parts for the benefit of the nation."

14 Methods of announcing the hours.

The division of the day being ascertained, it soon became an object to indicate in a public manner the expiration of any particular hour or division; as without some general knowledge of this kind, it would be in a great measure impossible to carry on business. The methods of announcing this have been likewise very different. Among the Egyptians it was customary for the priests to proclaim the hours like watchmen among us. The same method was followed at Rome; nor was there any other method of knowing the hours until the year 293 B.C. when Papirius Cursor first set up a sun-dial in the Capitol. A similar method is practised among the Turks, whose priests proclaim from the top of their mosques, the cock-crowing, day-break, mid-day, three o'clock in the afternoon, and twilight, being their appointed times of worship.

15 Invention of instruments for this purpose.

As this mode of proclaiming the hour could not but be very inconvenient as well as imperfect, the introduction of an instrument which every one could have in his possession, and which might answer the same purpose, must have been considered as a valuable acquisition. One of the first of these was the clepsydra or water clock *. Various kinds of these were in use among the Egyptians at a very early period. The invention of the instrument is attributed to Thoth or Mercury, and it was afterwards improved by Ctesibus of Alexandria. It was a common measure of time among the Greeks, Indians, and Chaldæans, as well as the Egyptians, but was not introduced into Rome till the time of Scipio Nasica. The Chinese astronomers have long made use of it; and by its means divided the zodiac into twelves parts; but it is a very inaccurate measure of time, varying, not only according to the quantity of water in the vessel, but according to the state of the atmosphere.

* See *Clepsydra*.

The clepsydra was succeeded by the gnomon or sun-dial.—This, at first, was no more than a stile erected perpendicularly to the horizon; and it was a long time before the principles of it came to be thoroughly understood. The invention is with great probability attributed to the Babylonians, from whom the Jews received it before the time of Ahaz, when we know that a sun-dial was already erected at Jerusalem. The Chinese and Egyptians also were acquainted with the use of the dial at a very early period, and it was considerably improved by Anaximander or Anaximenes; one of whom is for that reason looked upon to be the inventor. Various kinds of dials, however, were invented and made use of in different nations long before their introduction at Rome. The first erected in that city, as has been already mentioned, was that by Papirius Cursor; and 30 years after, Valerius Messala brought one from Sicily, which was used in Rome for no less than 99 years, though constructed for a Sicilian latitude, and consequently incapable of showing the hours exactly in any other place; but at last another was constructed by L. Philippus, capable of measuring time with greater accuracy.

It was long after the invention of dials before mankind began to form any idea of clocks; nor is it well known at what period they were first invented. A clock was sent by Pope Paul I. to Pepin king of France, which at that time was supposed to be the only one in the world. A very curious one was also sent to Charles the Great from the khalif Haroun Alraschid, which the historians of the time speak of with surprise and admiration: but the greatest improvement was that of Mr Huygens, who added the pendulum to it. Still, however, the instruments for dividing time were found to be inaccurate for nice purposes. The expansion of the materials by heat, and their contraction by cold, would cause a very perceptible alteration in the going of an instrument in the same place at different times of the year, and much more if carried from one climate to another. Various methods have been contrived to correct this; which indeed can be done very effectually at land by a certain construction of the pendulum; but at sea, where a pendulum cannot be used, the inaccuracy is of consequence much greater: nor was it thought possible to correct the errors arising from these causes in any tolerable degree, until the late invention of Mr Harrison's time-piece, which may be considered as making perhaps as near an approach to perfection as possible.

Having thus given an account of the more minute divisions of time, with the methods of measuring them, we must now proceed to the larger; which more properly belong to chronology, and which must be kept on record, as no instrument can be made to point them out. Of these the division into weeks of seven days is one of the most ancient, and probably took place from the creation of the world. Some, indeed, are of opinion, that the week was invented some

16 Of weeks.

ſome time after for the more convenient notation of time; but whatever may be in this, we are certain that it is of the higheſt antiquity, and even the moſt rude and barbarous nations have made uſe of it. It is ſingular indeed that the Greeks, notwithſtanding their learning ſhould have been ignorant of this diviſion; and M. Goguet informs us, that they were almoſt the only nation who were ſo. By them the month of 30 days was divided into three times 10, and the days of it named accordingly. Thus the 15th day of the month was called the *ſecond fifth*, or fifth of the ſecond tenth; the 24th was called the *third fourth*, or the fourth day of the third tenth. This method was in uſe in the days of Heſiod, and it was not until ſeveral ages had elapſed, that the uſe of weeks was received into Greece from the Egyptians. The inhabitants of Cathay, in the northern part of China, were likewiſe unacquainted with the week of ſeven days, but divided the year into ſix parts of 60 days each. They had alſo a cycle of 15 days, which they uſed as a week. The week was likewiſe unknown to the ancient Perſians and to the Mexicans; the former having a different name for every day of the month, and the latter making uſe of a cycle of 13 days. By almoſt all other nations the week of ſeven days was adopted.

17 Of holidays. It is remarkable, that one day in the week has always been accounted as ſacred by every nation. Thus Saturday was conſecrated to pious purpoſes among the Jews, Friday by the Turks, Tueſday by the Africans of Guinea, and Sunday by the Chriſtians. Hence alſo the origin of *Feriæ* or holidays, frequently made uſe of in ſyſtems of Chronology; and which aroſe from the following circumſtance. In the church of Rome the old eccleſiaſtical year began with Eaſter-week; all the days of which were called *Feriæ* or *Feriati*, that is, holy, or ſacred days; and in proceſs of time the days of other weeks came to be diſtinguiſhed by the ſame appellation, for the two following reaſons: 1. Becauſe every day ought to be holy in the eſtimation of a Chriſtian. 2. Becauſe all days are holy to eccleſiaſtics, whoſe time ought to be entirely devoted to religious worſhip.—The term *week* is ſometimes uſed to ſignify ſeven years, not only in the prophetical writings, but likewiſe by profane authors; thus Varro, in his book inſcribed *Hebdomades*, informs, that he had then entered the 12th week of his years.

18 Of months. The next diviſion of time ſuperior to weeks, is that of *months*. This appears to have been, if not coeval with the creation, at leaſt in uſe before the flood. As this diviſion is naturally pointed out by the revolution of the moon, the months of all nations were originally lunar; until after ſome conſiderable advances had been made in ſcience, the revolutions of that luminary were compared with the ſun, and thus the limits of the month fixed with greater accuracy. The diviſion of the year into 12 months, as being founded on the number of full revolutions of the moon in that time, has alſo been very general; though Sir John Chardin informs us, that the Perſians divided the year into 24 months; and the Mexicans into 18 months of 20 days each. The months generally contained 30 days, or 29 and 30 days alternately; though this rule was far from being without exception. The months of the Latins conſiſted of 16, 18, 22, or 36 days; and Romulus gave his people a year of 10 months and 304 days. The Kamtſchadales divide the year into 10 months; reckoning the time proper for labour to be nine months, and the winter ſeaſon, when they are obliged to remain inactive, only as one month.

It has been a very ancient cuſtom to give names to the different months of the year, though this appears to have been more modern than the departure of the Iſraelites out of Egypt, as they would otherwiſe undoubtedly have carried it with them; but for a conſiderable time after their ſettlement in Canaan, they diſtinguiſhed the months only by the names of firſt, ſecond, *&c.* After their return from the Babyloniſh captivity, they adopted the names given to the months by the Chaldæans. Other nations adopted various names, and arranged the months themſelves according to their fancy. From this laſt circumſtance ariſes the variety in the dates of the months; for as the year has been reckoned from different ſigns in the ecliptic, neither the number nor the quantity of months have been the ſame, and their ſituation has likewiſe been altered by the intercalations neceſſary to be made.

Theſe intercalations became neceſſary on account of the exceſs of the ſolar above the lunar year; and the months compoſed of intercalary days are likewiſe called *emboliſmal*. Theſe emboliſmal months are either *natural* or *civil*. By the former, the ſolar and lunar years are adjuſted to one another; and the latter ariſes from the defect of the civil year itſelf. The *Veadar* of the Jews, which always conſiſts of 30 days, is an example of the natural emboliſmal month.

The Romans had a method of dividing their months into kalends, nones, and ides. The firſt was derived from an old word *calo*, "to call"; becauſe, at every new moon, one of the lower claſs of prieſts aſſembled the people, and called over, or announced, as many days as intervened betwixt that and the nones, in order to notify the difference of times and the return of feſtivals. The 2d, 3d, 4th, 5th, 6th, and 7th of March, May, July, and October, were the nones of theſe months; but in the other months were the 2d, 3d, 4th and 5th days only. Thus the 5th of January was its nones; the 4th was *pridie nonarum*; the third, *tertio nonarum*, &c. The ides contained eight days in every month, and were nine days diſtant from the nones. Thus the 15th day of the four months already mentioned was the ides of them; but in the others the 13th was accounted as ſuch; the 12th was *pridie iduum*, and the 11th *tertio iduum*. The ides were ſucceeded by the kalends; the 14th of January, for inſtance, being the 19th kalend of February; the 15th was the 18th kalend; and ſo on till the 31ſt of January, which was *pridie kalendarum*; and February 1ſt was the kalends.

19 Aſtronomical and civil months. Among the European nations the month is either aſtronomical or civil. The former are meaſured by the motion of the heavenly bodies; the civil conſiſts of a certain number of days ſpecified by the laws, or by the civil inſtitutions of any nation or ſociety. The aſtronomical months, being for the moſt part regulated by the motions of the ſun and moon, are thus divided into ſolar and lunar, of which the former is ſometimes alſo called *civil*. The aſtronomical ſolar month is the time

time which the ſun takes up in paſſing through a ſign of the ecliptic. The lunar month is periodical, ſynodical, ſidereal, and civil. The ſynodical lunar month is the time that paſſes between any conjunction of the moon with the ſun and the conjunction following. It includes the motion of the ſun eaſtward during that time; ſo that a mean lunation conſiſts of 29d. 12h. 44′ 2″ 8921. The ſidereal lunar month is the time of the mean revolution of the moon with regard to the fixed ſtars. As the equinoctial points go backwards about 4″ in the ſpace of a lunar month, the moon muſt, in conſequence of this retroceſſion, arrive at the equinox ſooner than at any fixed ſtar, and conſequently the mean ſidereal revolution muſt be longer than the mean periodical one. The latter conſiſts of 27d. 7h. 43′ 4″ 6340. The civil lunar month is computed from the moon, to anſwer the ordinary purpoſes of life; and as it would have been inconvenient, in the computation of lunar months, to have reckoned odd parts of days, they have been compoſed of 30 days, or of 29 and 30 alternately, as the neareſt round numbers. When the month is reckoned from the firſt appearance of the moon after her conjunction, it is called the *month of illumination*. The Arabs, Turks, and other nations, who uſe the era of the Hegira, follow this method of computation. As twelve lunar months however, are 11 days leſs than a ſolar year, Julius Cæſar ordained that the month ſhould be reckoned from the courſe of the ſun, and not of the moon; and that they ſhould conſiſt of 30 and 31 days alternately, February only excepted, which was to conſiſt of 28 days commonly, and of 29 in leap-years.

The higheſt natural diviſion of time is into years. At firſt, however, it is probable that the courſe of the ſun through the ecliptic would not be obſerved, but that all nations would meaſure their time by the revolutions of the moon. We are certain, at leaſt, that the

19 Of years. Egyptian year conſiſted originally of a ſingle lunation; though at length it included two or three months, and was determined by the ſtated returns of the ſeaſons. As the eaſtern nations, however, particularly the Egyptians, Chaldeans, and Indians, applied themſelves in very early periods to aſtronomy, they found, by comparing the motions of the ſun and moon together, that one revolution of the former included nearly 12 of the latter. Hence a year of 12 lunations was formed, in every one of which were reckoned 30 days; and hence alſo the diviſion of the ecliptic into 360 degrees. The luniſolar year, conſiſting of 360 days, was in uſe long before any regular intercalations were made; and hiſtorians inform us, that the year of all ancient nations was luniſolar. Herodotus relates, that the Egyptians firſt divided the year into 12 parts by the aſſiſtance of the ſtars, and that every part conſiſted of 30 days. The Thebans corrected this year by adding 5 intercalary days to it. The old Chaldean year was alſo reformed by the Medes and Perſians; and ſome of the Chineſe miſſionaries have informed us, that the luniſolar year was alſo corrected in China: and that the ſolar year was aſcertained in that country to very conſiderable exactneſs. The Latin year, before Numa's correction of it, conſiſted of 360 days, of which 304 were divided into ten months; to which were added two private months not mentioned in the kalendar.

The imperfection of this method of computing time is now very evident. The luniſolar year was about $5\frac{1}{4}$ days ſhorter than the true ſolar year, and as much longer than the lunar. Hence the months could not long correſpond with the ſeaſons, and even in ſo ſhort a time as 34 years, the winter months would have changed places with thoſe of ſummer. From this rapid variation, Mr Playfair takes notice that a paſſage in Herodotus, by which the learned have been exceedingly puzzled, may receive a ſatisfactory ſolution, *viz.* that "in the time of the ancient Egyptian kings, the ſun had twice ariſen in the place where it had formerly ſet, and twice ſet where it had ariſen." By this he ſuppoſes it is meant, "that the beginning of the year had twice gone through all the ſigns of the ecliptic; and that the ſun had riſen and ſet twice in every day and month of the year." This, which ſome have taken for a proof of moſt extravagant antiquity, he further obſerves, might have happened in 138 years only; as in that period there would be a difference of nearly two years between the ſolar and lunar year. Such evident imperfections could not but produce a reformation every where; and accordingly we find that there was no nation which did not adopt the method of adding a few intercalary days at certain intervals. We are ignorant, however, of the perſon who was the firſt inventor of this method. The Theban prieſts attributed the invention to Mercury or Thoth; and it is certain that they were acquainted with the year of 365 days at a very early period. The length of the ſolar year was repreſented by the celebrated golden circle of Oſymandyas of 365 cubits circumference; and on every cubit of which was inſcribed a day of the year, together with the helaical riſings and ſettings of the ſtars. The monarch is ſuppoſed to have reigned in the 11th or 13th century before the Chriſtian era.

20 Explanation of a paſſage in Herodotus.

21 Great Egyptian year, or canicular cycle.

The Egyptian ſolar year being almoſt ſix hours ſhorter than the true one, this inaccuracy, in proceſs of time produced another revolution; for ſome circumſtances attending which ſerve to fix the date of the diſcovery of the length of the year, and which from the above deſcription of the golden circle, we may ſuppoſe to have been made during the reign of Oſymandyas. The inundation of the Nile was annually announced by the heliacal riſing of Sirius, to which the reformers of the kalendar adjuſted the beginning of the year, ſuppoſing that it would have remained immoveable. In a number of years, however, it appeared that their ſuppoſitions in this were ill-founded. By reaſon of the inequality abovementioned, the heliacal riſings of Sirius gradually advanced nearly at the rate of one day in four years; ſo that in 1461 years it completed a revolution, by ariſing on every ſucceeding day of the year, and returning to the point originally fixed for the beginning of the year. This period, equal to 1460 Julian years, was termed the *great Egyptian year*, or *canicular cycle*. From the accounts we have of the time that the canicular cycle was renewed, the time of its original commencement may be gathered with tolerable certainty. This happened, according to Cenſorinus, in the 138th year of the Chriſtian æra. Reckoning backward therefore from this time for 1460 years, we come to the year B.C. 1322, when the ſun was in Cancer, about 14 or 15 days after the ſummer ſolſtice

21 Of the time when it commenced.

solstice, which happened on July 5th. The Egyptians used no intercalation till the time of Augustus, when the corrected Julian year was received at Alexandria by his order; but even this order was obeyed only by the Greeks and Romans who resided in that city; the superstitious natives refusing to make any addition to the length of a year which had been so long established among them.

22
Uncertainty of the time when the true solar year was discovered.

We are not informed at what precise period the true year was observed to consist of nearly six hours more than the 365 days. Though the priests of Thebes claim the merit of the discovery, Herodotus makes no mention of it; neither did Thales, who introduced the year of 365 days into Greece, ever use any intercalation. Plato and Eudoxus are said to have obtained it as a secret from the Egyptians about 80 years after Herodotus, and to have carried it into Greece; which showed, that the knowledge of this form of the year was at that time recent, and only known to a few learned men.

23
Years of the Jews, &c.

The year of the ancient Jews was lunisolar; and we are informed by tradition, that Abraham preserved in his family, and transmitted to posterity, the Chaldean form of the year, consisting of 360 days; which remained the same without any correction until the date of the era of Nabonassar. The solar year was adopted among them after their return from the Babylonish captivity; but when subjected to the successors of Alexander in Syria, they were obliged to admit the lunar year into their kalendar. In order to adjust this year to the course of the sun, they added at certain periods a month to Adar, formerly mentioned, and called it *Ve'Adar*. They composed also a cycle of 19 years, in seven of which they inserted the intercalary month. This correction was intended to regulate the months in such a manner, as to bring the 15th of Nisan to the equinoctial point; and likewise the courses of the seasons and feasts in such a manner, that the corn might be ripe at the passover as the law required.

24
Reformation of the kalendar by Julius Cæsar and pope Gregory.

We shall not take up the reader's time with any further account of the years made use of by different nations, all of which are resolved at last into the lunisolar, it will be sufficient to mention the improvements in the kalendar made by the two great reformers of it, Julius Cæsar, and Pope Gregory XIII. The institution of the Roman year by Romulus has been already taken notice of; but as this was evidently very imperfect, Numa, on his advancement to the throne, undertook to reform it. With a design to make a complete lunar year of it, he added 50 days to the 304 of Romulus; and from every one of his months, which consisted of 31 and 30 days, he borrowed one day. Of these additional days he composed two months; calling the one January, and the other February. Various other corrections and adjustments were made; but when Julius Cæsar obtained the sovereignty of Rome, he found that the months had considerably receded from the seasons to which Numa had adjusted them. To bring them forward to their places, he formed a year of 15 months, or 445 days; which, on account of its length, and the design with which it was formed, has been called the *year of confusion*. It terminated on the first of January 45 B. C. and from this period the civil year and months were regulated by the course of the sun. The year of Numa being ten days shorter than the solar year, two days were added by Julius to every one of the months of January, August, and December; and one to April, June, September, and November. He ordained likewise, that an intercalary day should be added every fourth year to the month of February, by reckoning the 24th day, or sixth of the kalends of March, twice over. Hence this year was styled *bissextile*, and also *leap-year*, from its leaping a day more than a common year.

The Julian year has been used by modern chronologers, as being a measure of time extremely simple and sufficiently accurate. It is still, however, somewhat imperfect; for as the true solar year consists of 365d. 5h. 48′ 45¼″, it appears that in 131 years after the Julian correction, the sun must have arrived one day too soon at the equinoctial point. During Cæsar's reign the vernal equinox had been observed by Sosigenes on the 25th of March; but by the time of the Nicene council it had gone backward to the 21st. The cause of the error was not then known; but in 1582, when the equinox happened on the 11th of March it was thought proper to give the kalendar its last correction. Pope Gregory XIII. having invited to Rome a considerable number of mathematicians and astronomers, employed ten years in the examination of their several formulæ, and at last gave the preference to that of Alosia and Antoninus Lelius, who were brothers. Ten days were now cut off in the month of October, and the 4th of that month was reckoned the 15th. To prevent the seasons from receding in time to come, he ordained that one day should be added every fourth or bissextile year as before; and that the 1600th year of the Christian era, and every fourth century thereafter, should be a bissextile or leap year. One day therefore is to be intercalated in the years 2000, 2400, 2800, &c. but in the other centuries, as 1700, 1800, 1900, 2100, &c. it is to be suppressed and these are to be reckoned as common years. Even this correction, however, is not absolutely exact; but the error must be very inconsiderable, and scarce amounting to a day and a half in 5000 years.

25
Commencement of the year.

The commencement of the year has been determined by the date of some memorable event or occurrence, such as the creation of the world, the universal deluge, a conjunction of planets, the incarnation of our Saviour, &c. and of course has been referred to different points in the ecliptic. The Chaldæan and the Egyptian years were dated from the autumnal equinox. The ecclesiastical year of the Jews began in the spring; but in civil affairs, they retained the epoch of the Egyptian year. The ancient Chinese reckoned from the new moon nearest to the middle of Aquarius; but, according to some recent accounts, the beginning of their year was transferred (B. C. 1740) to the new moon nearest to the winter solstice. This likewise is the date of the Japanese year. Diemschid, or Gemschid, king of Persia, observed, on the day of his public entry into Persepolis, that the sun entered into Aries. In commemoration of this fortunate event and coincidence, he ordained the beginning of the year to be removed from the autumnal to the vernal equinox. This epoch was denominated *Neuruz*, viz. new-day; and is still celebrated with great pomp and festivity.

(See Epochs). The ancient Swedish year commenced at the winter solstice, or rather at the time of the sun's appearance in the horizon, after an absence of about 40 days. The feast of this epoch was solemnised on the 20th day after the solstice. Some of the Grecian states computed from the vernal, some from the autumnal equinox, and others from the summer tropic. The year of Romulus commenced in March, and that of Numa in January. The Turks and Arabs date the year from the 16th of July and the American Indians reckon from the first appearance of the new moon of the vernal equinox. The church of Rome has fixed new-year's-day on the Sunday that corresponds with the full moon of the same season. The Venetians, Florentines, and Pisans in Italy, and the inhabitants of Treves in Germany, begin the year at the vernal equinox. The ancient clergy reckoned from the 25th of March; and this method was observed in Britain, until the introduction of the new style (A. D. 1752); after which the year commenced on

26 Of cycles. the 1st day of January.

Besides the natural divisions of time arising immediately from the revolutions of the heavenly bodies, there are others formed from some of the less obvious consequences of these revolutions, which are called *cycles*, from the Greek κυκλος, *a circle*. The most remarkable of these are the following.

1. The *cycle of the sun* is a revolution of 28 years, in which time the days of the months return again to the same days of the week; the sun's place to the same signs and degrees of the ecliptic on the same months and days, so as not to differ one degree in 100 years; and the leap-years begin the same course over again with respect to the days of the week on which the days of the months fall.

27 Golden number. The *cycle of the moon*, commonly called the *golden number*, is a revolution of 19 years; in which time the conjunctions, oppositions, and other aspects of the moon, are within an hour and a half of being the same as they were on the same days of the months 19 years before. The *indiction* is a revolution of 15 years, used only by the Romans for indicating the times of certain payments made by the subjects to the republic: It was established by Constantine, A. D. 312.

28 To find the year of any cycle. The year of our Saviour's birth, according to the vulgar era, was the 9th year of the solar cycle, the first year of the lunar cycle; and the 312th year after his birth was the first year of the Roman indiction. Therefore, to find the year of the solar cycle, add 9 to any given year of Christ, and divide the sum by 28, the quotient is the number of cycles elapsed since his birth, and the remainder is the cycle for the given year; If nothing remains, the cycle is 28. To find the lunar cycle, add one to the given year of Christ, and divide the sum by 19; the quotient is the number of cycles elapsed in the interval, and the remainder is the cycle for the given year: If nothing remains, the cycle is 19. Lastly, subtract 312 from the given year of Christ, and divide the remainder by 15; and what remains after this division is the indiction for the given year: If nothing remains, the indiction is 15.

29 Variation of the golden numbers. Although the above deficiency in the lunar circle of an hour and an half every 19 years be but small, yet in time it becomes so sensible as to make a whole natural day in 310 years. So that, although this cycle be of use, when the golden numbers are rightly placed against the days of the months in the kalendar, as in the Common Prayer Books, for finding the days of the mean conjunctions or oppositions of the sun and moon, and consequently the time of Easter; it will only serve for 310 years, old stile. For as the new and full moons anticipate a day in that time, the golden numbers ought to be placed one day earlier in the kalendar for the next 310 years to come. These numbers were rightly placed again the days of new moon in the kalendar, by the council of Nice, A. D. 325; but the anticipation, which has been neglected ever since, is now grown almost into 5 days: And therefore all the golden numbers ought now to be placed five days higher in the kalendar for the old stile than they were at the time of the said council; or 6 days lower for the new style, because at present it differs 11 days from the old. 30

To find the golden number. In the first of the following tables the golden numbers under the months stand against the days of new moon in the left-hand column, for the new style; adapted chiefly to the second year after leap-year, as being the nearest mean for all the four; and will serve till the year 1900. Therefore to find the day of new moon in any month of a given year till that time, look for the golden number of that year under the desired month, and against it you have the day of new moon in the left hand column. Thus, suppose it were required to find the day of new moon in September 1789; the golden number for that year is 4, which I look for under December, and right against it in the left-hand column you will find 17, which is the day of new moon in that month. *N. B.* If all the golden numbers, except 17, and 6, were set one day lower in the table, it would serve from the beginning of the year 1900 till the end of the year 2199. The table at the end of this section shows the golden number for 4000 years after the birth of Christ, by looking for the even hundreds of any given year at the left-hand, and for the rest to make up that year at the head of the table; and where the columns meet, you have the golden number (which is the same both in old and new style) for the given year. Thus, suppose the golden number was wanted for the year 1789; look for 1700 at the left-hand of the table, and for 89 at the top of it; then guiding your eye downward from 89 to over-against 1700, you will find 4, whch is the golden number for that year.

But because the lunar cycle of 19 years sometimes includes five leap-years, and at other times only four, this table will sometimes vary a day from the truth in leap-years after February. And it is impossible to have one more correct, unless we extend it to four times 19 or 76 years; in which there are 19 leap-years without a remainder. But even then to have it of perpetual use, it must be adapted to the old style; because, in every centurial year not divisible by 4, the regular course of leap-years is interrupted in the new, as will be the case in the year 1800. 31

Dionysian period, or cycle of Easter. 2. The *cycle of Easter*, also called the *Dionysian period*, is a revolution of 532 years, found by multiplying the solar cycle 28 by the lunar cycle 19. If the new moons did not anticipate upon this cycle, Easter-day would always

always be the Sunday next after the first full moon which follows the 21st of March. But, on account of the above anticipation, to which no proper regard was had before the late alteration of the style, the ecclesiastic Easter has several times been a week different from the true Easter within this last century: which inconvenience is now remedied by making the table, which used to find Easter for ever, in the Common Prayer Book, of no longer use than the lunar difference from the new style will admit of.

The earliest Easter possible is the 22d of March, the latest the 25th of April. Within these limits are 35 days, and the number belonging to each of them is called the *number of direction;* because thereby the time of Easter is found for any given year.

32 Dominical letter.

The first seven letters of the alphabet are commonly placed in the annual almanacs, to show on what days of the week the days of the months fall throughout the year. And because one of those seven letters must necessarily stand against Sunday, it is printed in a capital form, and called the *dominical letter;* the other six being inserted in small characters, to denote the other six days of the week. Now, since a common Julian year contain 365 days, if this number be divided by 7 (the number of days in a week) there will remain one day. If there had been no remainder, it is plain the year would constantly begin on the same day of the week: but since one remains, it is plain, that the year must begin and end on the same day of the week; and therefore the next year will begin on the day following. Hence, when January begins on Sunday, A is the dominical or Sunday letter for that year: Then, because the next year begins on Monday, the Sunday will fall on the seventh day, to which is annexed the seventh letter G, which therefore will be the dominical letter for all that year: and as the third year will begin on Tuesday, the Sunday will be on the sixth day; therefore F will be the Sunday letter for that year. Whence it is evident, that the Sunday letters will go annually in a retrograde order, thus, G, F, E, D, C, B, A. And, in the course of seven years, if they were all common ones, the same days of the week and dominical letters would return to the same days of the months. But because there are 366 days in a leap-year, if this number be divided by 7, there will remain two days over and above the 52 weeks of which the year consists. And therefore, if the leap-year begins on Sunday, it will end on Monday; and the next year will begin on Tuesday, the first Sunday whereof must fall on the sixth of January, to which is annexed the letter F, and not G, as in common years. By this means, the leap-year returning every fourth year, the order of the dominical letter is interrupted; and the series cannot return to its first state till after four times seven, or 28 years; and then the same days of the months return in order to the same days of the week as before.

TABLE I.

| Days. | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9 | | 9 | 17 | 17 | 6 | | | | 11 | | 19 |
| 2 | | 17 | | | 6 | 14 | 14 | 3 | 11 | | 19 | |
| 3 | 17 | 6 | 17 | 6 | | | 3 | 11 | | 19 | 8 | 8 |
| 4 | 6 | | 6 | 14 | 14 | 3 | | | 19 | 8 | | 16 |
| 5 | | 14 | | | 3 | 11 | 11 | 19 | 8 | | 16 | |
| 6 | 14 | 3 | 14 | 3 | | | 19 | | | 16 | 5 | 5 |
| 7 | 3 | | 3 | 11 | 11 | 19 | | 8 | 16 | | | 13 |
| 8 | | 11 | | | 19 | 8 | 8 | 16 | 5 | 5 | 13 | |
| 9 | 11 | 19 | 11 | 19 | | | | | | 13 | | 2 |
| 10 | | | 19 | 8 | 8 | 16 | 16 | 5 | 13 | | 2 | 10 |
| 11 | 19 | 8 | | | | | 5 | 13 | 2 | 2 | 10 | |
| 12 | 8 | 16 | 8 | 16 | 16 | 5 | | | | 10 | | 18 |
| 13 | | | | | 5 | 13 | 13 | 2 | 10 | | 18 | 7 |
| 14 | 16 | 5 | 16 | 5 | | | 2 | 10 | 18 | 18 | 7 | |
| 15 | 5 | | 5 | 13 | 13 | 2 | | | | 7 | | 15 |
| 16 | | 13 | | 2 | 2 | 10 | 10 | 18 | 7 | | 15 | |
| 17 | 13 | 2 | 13 | | | 18 | 18 | 7 | | 15 | 4 | 4 |
| 18 | 2 | | 2 | 10 | 10 | | | | 15 | | | 12 |
| 19 | | 10 | | 18 | 18 | 7 | 7 | 15 | 4 | 4 | 12 | |
| 20 | 10 | 18 | 10 | | | | 15 | | | 12 | 1 | 1 |
| 21 | 18 | | 18 | 7 | 7 | 15 | | 4 | 12 | | | 9 |
| 22 | | 7 | | | 15 | 4 | 4 | 12 | 1 | 1 | 9 | |
| 23 | 7 | 15 | 7 | 15 | | | 12 | | | 9 | 17 | 17 |
| 24 | | | 15 | 4 | 4 | 12 | | 1 | 9 | | | 6 |
| 25 | 15 | 4 | | | 12 | | 1 | 9 | 17 | 17 | 6 | |
| 26 | 4 | | 4 | 12 | | 1 | | | | 6 | | 15 |
| 27 | | 12 | | 1 | 1 | 9 | 9 | 17 | 6 | | 14 | |
| 28 | 12 | 1 | 12 | | 9 | | 17 | 6 | 14 | 14 | 3 | 3 |
| 29 | 1 | | 1 | 9 | | 17 | | | | 3 | | 11 |
| 30 | | | | | 17 | 6 | 6 | 14 | 3 | | 11 | |
| 31 | 9 | | 9 | | | | 14 | 3 | | 11 | | 19 |

TABLE II.

TABLE, *showing the Golden Number, (which is the same both in the Old and New Stile), from the Christian Era, to A. D.* 4000.

| Hundreds of Years. | | | Years less than an hundred. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0<br>19<br>38<br>57<br>76<br>95 | 1<br>20<br>39<br>58<br>77<br>96 | 2<br>21<br>40<br>59<br>78<br>97 | 3<br>22<br>41<br>60<br>79<br>98 | 4<br>23<br>42<br>61<br>80<br>99 | 5<br>24<br>43<br>62<br>81 | 6<br>25<br>44<br>63<br>82 | 7<br>26<br>45<br>64<br>13 | 8<br>27<br>46<br>65<br>84 | 9<br>28<br>47<br>66<br>85 | 10<br>29<br>48<br>67<br>86 | 11<br>30<br>49<br>68<br>87 | 12<br>31<br>50<br>69<br>88 | 13<br>32<br>51<br>70<br>89 | 14<br>33<br>52<br>71<br>90 | 15<br>34<br>53<br>72<br>91 | 16<br>35<br>54<br>73<br>92 | 17<br>36<br>55<br>74<br>93 | 18<br>37<br>56<br>75<br>94 |
| 0 | 1900 | 3800 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 100 | 2000 | 3900 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 |
| 200 | 2100 | 4000 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 300 | 2200 | &c. | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 400 | 2300 | — | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 |
| 500 | 2400 | — | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 |
| 600 | 2500 | — | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 700 | 2600 | — | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 800 | 2700 | — | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 |
| 900 | 2800 | — | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1000 | 2900 | — | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1100 | 3000 | — | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 1200 | 3100 | — | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 |
| 1300 | 3200 | — | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1400 | 3300 | — | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 1500 | 3400 | — | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 1600 | 3500 | — | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 |
| 1700 | 3600 | — | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1800 | 3700 | — | 15 | 16 | 17 | 18 | 19 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

33 Julian period.

From the multiplication of the solar cycle of 28 years into the lunar cycle of 19 years, and the Roman indiction of 15 years, arises the great Julian period, consisting of 7980 years, which had its beginning 764 years before Strauchius's supposed year of the creation (for no later could all the three cycles begin together), and it is not yet completed: And therefore it includes all other cycles, periods, and eras. There is but one year in the whole period that has the same numbers for the three cycles of which it is made up: And therefore, if historians had remarked in their writings the cycles of each year, there had been no dispute about the time of any action recorded by them.

34 To find the year of the Julian period.

The Dionysian or vulgar era of Christ's birth was about the end of the year of the Julian period 4713: and consequently the first year of his age, according to that account, was the 4714th year of the said period. Therefore, if to the current year of Christ we add 4713, the sum will be the year of the Julian period. So the year 1789 will be found to be the 6502d year of that period. Or, to find the year of the Julian period answering to any given year before the first year of Christ, subtract the number of that given year from 4471, and the remainder will be the year of the Julian period. Thus, the year 585 before the first year of Christ) which was the 584th before his birth) was the 4129th year of the said period. Lastly, to find the cycles of the sun, moon, and indiction for any given year of this period, divide the given year by 28, 19, and 15; the three remainders will be the cycles sought, and the quotients the numbers of cycles run since the beginning of the period. So in the above 4714th year of the Julian period, the cycle of the sun was 10, the cycle of the moon 2, and the cycle of the indiction 4; the solar cycle having run through 168 courses, the lunar 248, and the indiction 314.

35 Year of Christ's birth when settled.

The vulgar era of Christ's birth was never settled till the year 527, when Dionysius Exiguus, a Roman abbot, fixed it to the end of the 4713th year of the Julian period, which was four years too late; for our Saviour was born before the death of Herod, who sought to kill him as soon as he heard of his birth. And, according to the testimony of Josephus [*B.* xvii. *ch.* 8.), there was an eclipse of the moon in the time of Herod's last illness; which eclipse appears by our astronomical tables to have been in the year of the Julian period 4710, March 13th, at 3 hours past midnight, at Jerusalem. Now, as our Saviour must have been born some months before Herod's death, since in the interval he was carried into Egypt, the latest time in which we can fix the true æra of his birth is about the end of the 4709th year of the Julian period.

36 Eras or Epochs.

As there are certain fixed points in the heavens from which astronomers begin their computations, so there are

are certain points of time from which historians begin to reckon; and these points or roots of time are called *eras* or *epochs*. The most remarkable eras are, those of the Creation, the Greek Olympiads, the building of Rome, the era or Nabonassar, the death of Alexander, the birth of Christ, the Arabian Hegira, and the Persian Jesdegird: All which, together with several others of less note, have their beginnings fixed by chronologers to the years of the Julian period, to the age of the world at those times, and to the years before and after the year of Christ's birth.

37 Historic chronology

Having thus treated, as fully as our limits will admit, of the various divisions of time, we must now consider the second part of chronology, *viz.* that which more immediately relates to history, and which has already been observed to have the four following foundations: 1. Astronomical observations, particularly of eclipses. 2. The testimonies of credible authors. 3. Epochs in history universally allowed to be true. 4. Ancient medals, coins, monuments, and inscriptions. We shall consider these four principal parts in the order they here stand.

I.

38 Of eclipses of the sun and moon.

It is with great reason that the eclipses of the sun and moon, and the aspects of the other planets, have been called public and celestial characters of the times, as their calculations afford chronologers infallible proofs of the precise epochs in which a great number of the most signal events in history have occurred. So that in chronological matters we cannot make any great progress, if we are ignorant of the use of astronomic tables, and the calculation of eclipses. The ancients regarded the latter as prognostics of the fall of empires, of the loss of battles, of the death of monarchs, *&c.* And it is to this superstition, to this wretched ignorance, that we happily owe the vast labour that historians have taken to record so great a number of them. The most able chronologers have collected them with still greater labour. Calvisius, for example, founds his chronology on 144 eclipses of the sun, and 127 of the moon, that he says he had calculated. The grand conjunction of the two superior planets, Saturn and Jupiter, which, according to Kepler, occurs once in 800 years in the same point of the zodiac, and which has happened only eight times since the creation (the last time in the month of December (1603), may also furnish chronology with incontestable proofs. The same may be said of the transit of Venus over the sun, which has been observed in our days, and all the other uncommon positions of the planets. But among these celestial and natural characters of times, there are also some that are named *civil* or *artificial*, and which, nevertheless, depend on astronomic calculation.

Such are the solar and lunar cycles; the Roman indiction; the feast of Easter; the bissextile year; the jubilees; the sabbatic years; the combats and Olympic games of the Greeks; and hegira of the Mahometans, *&c.* And to these may be added the periods, eras, epochs, and years of different nations, ancient and modern. We shall only remark on this occasion, that the period or era of the Jews commences with the creation of the world; that of the ancient Romans with the foundation of the city of Rome; that of the Greeks at the establishment of the Olympic games; that of Nebuchadnezzar, with the advancement of the first king of Babylon to the throne; the Yezdegerdic years, with the last king of the Persians of that name; the hegira of the Turks with the flight of Mahomet from Mecca to Medina, *&c.* The year of the birth of Christ was the 4713th year of the Julian period, according to the common method of reckoning. Astronomical chronology teaches us to calculate the precise year of the Julian period in which each of these epochs happened.

II.

The testimony of authors is the second principal part of historic chronology. Though no man whatever has a right to pretend to infallibility, or to be regarded as a sacred oracle, it would, however, be making a very unjust judgment of mankind, to treat them all as dupes or impostors; and it would be an injury offered to public integrity, were we to doubt the veracity of authors universally esteemed, and of facts that are in themselves right worthy of belief. It would be even a kind of infatuation to doubt that there have been such cities as Athens, Sparta, Rome, Carthage, *&c.* or that Xerxes reigned in Persia, and Augustus in Rome: whether Hannibal ever was in Italy; or that the emperor Constantine built Constantinople, *&c.* The unanimous testimony of the most respectable historians will not admit any doubt of these matters. When an historian is allowed to be completely able to judge of an event, and to have no intent of deceiving by his relation, his testimony is irrecusable. But to avoid the danger of adopting error for truth, and to be satisfied of a fact that appears doubtful in history, we may make use of the four following rules, as they are founded in reason.

39 Of the testimony of authors.

1. We ought to pay a particular regard to the testimonies of those who wrote at the same time the events happened, and that have not been contradicted by any cotemporary author of known authority. Who can doubt, for example, of the truth of the facts related by admiral Anson, in the history of his voyage round the world? The admiral saw all the facts there mentioned with his own eyes, and published his book when two hundred companions of his voyage were still living in London, and could have contradicted him immediately, if he had given any false or exaggerated relations.

2. After the cotemporary authors, we should give more credit to those who lived near the time the events happened, than those who lived at a distance.

3. Those doubtful histories, which are related by authors that are but little known, can have no weight if they are at variance with reason, or established tradition.

4. We must distrust the truth of a history that is related by modern authors, when they do not agree among themselves in several circumstances, nor with ancient historians, who are to be regarded as original sources. We should especially doubt the truth of those brilliant portraits, that are drawn at pleasure by such as never knew the persons they are intended for, and even made several centuries after their decease.

The most pure and most fruitful source of ancient history

history is doubtless to be found in the Holy Bible. Let us here for a moment cease to regard it as divine, and let us presume to consider it as a common history. Now, when we regard the writers of the books of the Old Testament, and consider them sometimes as authors, sometimes as ocular witnesses, and sometimes as respectable historians; whether we reflect on the simplicity of the narration, and the air of truth that is there constantly visible; or, when we consider the care that the people, the governments, and the learned men of all ages, have taken to preserve the true text of the Bible; or that we have regard to the happy conformity of the chronology of the holy scriptures with that of profane history: or, if we observe the admirable harmony that is between these books and the most respectable historians, as Josephus and others: and lastly, when we consider that the books of the holy scripture furnish us alone with an accurate history of the world from the creation, through the line of patriarchs, kings, judges, and princes of the Hebrews; and that we may, by its aid, form an almost intire series of events down to the birth of Christ, or the time of Augustus, which comprehends a space of about 4000 years, some small interruptions excepted, and which are easily supplied by profane history: when all these reflections are justly made, we must constantly allow that the scriptures form a book which merits the first rank among all the sources of ancient history. It has been objected, that this book contains contradictions; but the most able interpreters have reconciled these seeming contradictions. It has been said, that the chronology of the Hebrew text and the Vulgate do not agree with the chronology of the version of the Septuagint; but the soundest critics have shown that they may be made to agree. It has been observed, moreover, that the scriptures abound with miracles and prodigies; but they are miracles that have really happened: and what ancient history is there that is not filled with miracles, and other marvellous events? And do we for that reject their authority? Cannot the true God be supposed to have performed those miracles which Pagan historians have attributed to their false divinities? Must we pay no regard to the writings of Livy, because his history contains many fabulous relations?

III.

40 Epochs. THE *epochs* form the third principal part of chronology. These are those fixed points in history that have never been contested, and of which there can, in fact, be no doubt. Chronologers fix on the events that are to serve as epochs, in a manner quite arbitrary; but this is of little consequence, provided the dates of these epochs agree, and that there is no contradiction in the facts themselves. When we come to treat expresly on history, we shall mention, in our progress, all the principal epochs.

IV.

41 Medals, &c. MEDALS, monuments, and inscriptions, form the fourth and last principal part of chronology. It is scarce more than 150 years since close application has been made to the study of these; and we owe to the celebrated Spanheim the greatest obligations, for the progress that is made in this method: his excellent work, *De præstantia et usu numismatum antiquorum*, has shown the great advantages of it; and it is evident that these monuments are the most authentic witnesses that can be produced. It is by the aid of medals that M. Vailant has composed his judicious history of the kings of Syria, from the time of Alexander the Great to that of Pompey: they have been, moreover, of the greatest service in elucidating all ancient history, especially that of the Romans; and even sometimes that of the middle age. Their use is more fully spoken of in the article MEDALS. What we here say of medals, is to be understood equally, in its full force, of ancient inscriptions, and of all other authentic monuments that have come down to us.

Every reader, endowed with a just discernment will readily allow that these four parts of chronology afford clear lights, and are excellent guides to conduct us through the thick darkness of antiquity. That impartiality, however, which directs us to give a faithful relation of that which is true and false, of the certainty and uncertainty of all the sciences, obliges us here freely to confess, that these guides are not infallible, nor the proofs that they afford mathematical demonstrations. In fact, with regard to history in general, and ancient history in particular, something must be always left to conjecture and historic faith. It would be an offence against common probity, were we to suffer ourselves to pass over in silence those objections which authors of the greatest reputation have made against the certainty of chronology. We shall extract them from their own works; and we hope that their is no magistrate, theologian, or public professor in Europe, who would be mean enough to accuse us of a crime, for not unworthily disguising the truth.

1. The prodigious difference there is between the Septuagint Bible and the Vulgate, in point of chronology, occasions an embarrassment, which is the more difficult to avoid as we cannot positively say on which side the error lies. The Greek Bible counts, for example, from the creation of the world to the birth of Abraham, 1500 years more than the Hebrew and Latin Bibles, *&c*. 2. How difficult is it to ascertain the years of the judges of the Jewish nation, in the Bible? What darkness is spread over the succession of the kings of Judah and Israel? The calculation of time is there so inaccurate, that the scripture never marks if they are current or complete years. For we cannot suppose that a patriarch, judge, or king, lived exactly 60, 90, 100, or 969 years, without any odd months or days. 3. The different names that the Assyrians, Egyptains, Persians and Greeks, have given to the same prince, have contributed not a little to embarrass all ancient chronology. Three or four princes have borne the name of Assuerus, though they had also other names. If we did not know that Nabucodonosor, Nabucodrosor, and Nabucolassar, were the same name, or the name of the same man, we should scarcely believe it. Sargon is Senacherib; Ozias is Azarias; Sedecias is Mathanias; Joachas is also called Sellum; Asaraddon, which is pronounced indifferently Esarhaddon and Asarhaddon, is called Asenaphar by the Cuthæans; and by an oddity of which we do not know the origin, Sardanapalus is called by

by the Greeks Tenos Concoleros. 4. There remain to us but few monuments of the first monarchs of the world. Numberless books have been lost, and those which have came down to us are mutilated or altered by transcribers. The Greeks began to write very late. Herodotus, their first historian, was of a credulous disposition, and believed all the fables that were related by the Egyptain priests. The Greeks were in general vain, partial, and held no nation in esteem but their own. The Romans were still more infatuated with notions of their own merit and grandeur, their historians were altogether as unjust as was their senate, toward other nations that were frequently far more respectable. 5. The eras, the years, the periods and epochs, were not the same in each nation; and they, moreover, began at different seasons of the year. All this has thrown so much obscurity over chronology, that it appears to be beyond all human capacity totally to disperse it.

Christianity itself had subsisted near 1200 years, before they knew precisely how many years had passed since the birth of our Saviour. They saw clearly that the vulgar era was defective, but it was a long time before they could comprehend that it required four whole years to make up the true period. Abbe Denis the Little, who in the year 532 was the first among the Christians to form the era of that grand epoch, and to count the years from that time, in order to make their chronology altogether Christian, erred in his calculation, and led all Europe into his error. They count 132 contrary opinions of different authors concerning the year in which the Messiah appeared on the earth. M. Vallemont names 64 of them, and all celebrated writers. Among all these authors, however, there is none that reckon more than 7000, nor less than 3700 years. But even this difference is enormous. The most moderate fix the birth of Christ in the 4000th year of the world. The reasons, however, on which they found their opinion, appear to be sufficiently arbitrary.

Be these matters, however, as they may, the wisdom of Providence has so disposed all things, that there remain sufficient lights to enable us nearly to connect the series of events: for in the first 3000 years of the world, where profane history is defective we have the chronology of the Bible to direct us; and after that period, where we find more obscurity in the chronology of the holy scriptures, we have, on the other hand, greater lights from profane authors. It is at this period that begins the time which Varro calls *historic*: as, since the time of the Olympiads, the truth of such events as have happened shines clear in history. Chronology, therefore, draws its principal lights from history; and in return, serves it as a guide. Referring the reader, therefore, to the article HISTORY, and the *Chart* thereto annexed, we shall conclude the present article with

*A* CHRONOLOGICAL TABLE *of Remarkable Events, Discoveries, and Inventions, from the Creation to the Year* 1789.

Bef. Christ.

4008 THE creation of the world, and Adam and Eve
4007 The birth of Cain, the first who was born of a woman.
3017 Enoch, for his piety, is translated to heaven.
2352 The old world is destroyed by a deluge which continued 377 days.
2247 The tower of Babel is built about this time by Noah's posterity; upon which God miraculously confounds their language, and thus disperses them into different nations.
2237 About this time, Noah is, with great probability, supposed to have parted from his rebellious offspring, and to have led a colony of some of the more tractable into the east, and there either he, or one of his successors to have founded the ancient Chinese monarchy.
2234 The celestial observations are begun at Babylon, the city which first gave birth to learning and the sciences.
2188 Misraim, the son of Ham, founds the kingdom of Egypt, which lasted 1663 years, down to the conquest of Cambyses, in 525 before Christ.
2059 Ninus, the son of Belus, founds the kingdom of Assyria, which lasted above 1000 years, and out of its ruins were formed the Assyrians of Babylon, those of Nineveh, and the kingdom of the Medes.
1985 The covenant of God made with Abram, when he leaves Haran to go into Canaan, which begin, the 430 years of sojourning.
1961 The cities of Sodom and Gomorra are destroyed for their wickedness by fire from heaven.
1856 The kingdom of Argos, in Greece, begins under Inachus.
1822 Memnon, the Egyptain, invents the letters.
1715 Prometheus first struck fire from flints.
1635 Joseph dies in Egypt.
1574 Aaron born in Egypt; 1490, appointed by God first high-priest of the Israelites.
1571 Moses, brother to Aaron, born in Egypt, and adopted by Pharaoh's daghter, who educates him in all the learning of the Egyptains.
1556 Cecrops brings a colony of Saites from Egypt into Attica, and begins the kingdom of Athens in Greece.
1555 Moses performs a number of miracles in Egypt; and departs from that kingdom, together with 600,000 Israelites, besides children, which completed the 430 years of sojourning. They miraculously pass through the Red Sea, and come to the desart of Sinai, where Moses receives from God, and delivers to the people, the Ten Commandments, and the other laws, and sets up the tabernacle, and in it the ark of the covenant.
1546 Scamander comes from Crete into Phrygia, and begins the kingdom of Troy.
1515 The Israelites, after sojourning in the wilderness forty years, are led under Joshua into the land of Canaan, where they fix themselves, after having subdued the natives; and the period of the sabbatical year commences.
1503 The deluge of Deucalion.
1496 The council of Amphictyons established at Thermopylæ.
1493 Cadmus carried the Phenician letters into Greece and built the citadel of Thebes.
1490 Sparta built by Lacedemon.

Before Christ.

Before Christ.

1485 The first ship that appeared in Greece was brought from Egypt by Danaus, who arrived at Rhodes, and brought with him his fifty daughters.
1480 Troy built by Dardanus.
1452 The Pentateuch, or five first books of Moses, are written in the land of Moab, where he died the year following, aged 110.
1406 Iron is found in Greece, from the accidental burning of the woods.
1344 The kingdom of Mycenæ begins.
1326 The Isthmian games instituted at Corinth.
1325 The Egyptian canicular year began July 20th.
1307 The Olympic games instituted by Pelops.
1300 The Lupercalia instituted.
1294 The first colony came from Italy into Sicily.
1264 The second colony came from Italy into Sicily.
1252 The city of Tyre built.
1243 A colony of Arcadians conducted by Evander into Italy.
1233 Carthage founded by the Tyrians.
1225 The Argonautic expedition.
1204 The rape of Helen by Paris, which gave rise to the Trojan war, ending with the destruction of the city in 1184.
1176 Salamis in Cyprus built by Teucer.
1152 Ascanius builds Alba Longa.
1130 The kingdom of Sicyon ended.
1124 Thebes built by the Bœotians.
1115 The mariner's compass known in China.
1104 The expedition of the Heraclidæ into Peloponnesus; the migration of the Dorians thither; and the end of the kingdom of Mycenæ.
1102 The kingdom of Sparta commenced.
1070 The kingdom of Athens ended.
1051 David besieged and took Jerusalem.
1044 Migration of the Ionian colonies.
1008 The Temple is solemnly dedicated by Solomon.
996 Solomon prepared a fleet on the Red Sea to send to Ophir.
986 Samos and Utica in Africa built.
979 The kingdom of Israel divided.
974 Jerusalem taken and plundered by Shishak king of Egypt.
911 The prophet Elijah flourished.
894 Money first made of gold and silver at Argos.
884 Olympic games restored by Iphitus and Lycurgus.
873 The art of sculpture in marble found out.
869 Scales and measures invented by Phidon.
864 The city of Carthage, in Africa, enlarged by queen Dido.
821 Nineveh taken by Arbaces.
814 The kingdom of Macedon begins.
801 The city of Capua in Compania built.
799 The kingdom of Lydia began.
786 The ships called *Triremes* invented by the Corinthians.
779 The race of kings in Corinth ended.
776 The era of the Olympiads began.
760 The Ephori established at Sparta.
758 Syracuse built by Archias of Corinth.
754 The government of Athens changed.
753 Era of the building of Rome in Italy by Romulus, first king of the Romans.
747 The era of Nabonassar commenced on the 26th of February; the first day of Thoth.
746 The government of Corinth changed into a republic.
743 The first war between the Messenians and Spartans.
724 Mycenæ reduced by the Spartans.
723 A colony of the Messenians settled at Rhegium in Italy.
720 Samaria taken, after three years siege, and the kingdom of Isreal finished by Salmanazer king of Assyria, who carries the ten tribes into captivity.
The first eclipse of the moon on record.
713 Gela in Sicily built.
703 Corcyra, now Corfu, founder of the Corinthians.
702 Ecbatan in Media built by Deioces.
685 The second Messenian war under Aristomenes.
670 Byzantium (now Constantinople) built by a colony of Athenians.
666 The city of Alba destroyed.
648 Cyrene in Africa founded.
634 Cyaxares besieges Nineveh, but is obliged to raise the siege by an incursion of the Scythians, who remained masters of Asia for 28 years.
624 Draco published his inhuman laws at Athens.
610 Pharaoh Necho attempted to make a canal from the Nile to the Red Sea, but was not able to accomplish it.
607 By order of the same monarch, some Phenicians sailed from the Red Sea round Africa, and returned by the Mediterranean.
606 The first captivity of the Jews by Nebuchadnezzar. Nineveh destroyed by Cyaxares.
600 Thales, of Miletus, travels into Egypt, consults the priests of Memphis, acquires the knowledge of geometry, astronomy, and philosophy; returns to Greece, calculates eclipses, gives general notions of the universe, and maintains that an only Supreme Intelligence regulates all its motions.
Maps, globes, and the signs of the zodiac, invented by Anaximander, the scholar of Thales.
598 Jehoiakin, king of Judah, is carried away captive, by Nebuchadnezzar, to Babylon.
594 Solon made Archon at Athens.
591 The Pythian games instituted in Greece, and tragedy first acted.
588 The first irruption of the Gauls into Italy.
586 The city of Jerusalem taken, after a siege of 18 months.
582 The last captivity of the Jews by Nebuchadnezzar.
581 The Isthmian games restored.
580 Money first coined at Rome.
571 Tyre taken by Nebuchadnezzar after a siege of 13 years.
566 The first census at Rome, when the number of citizens was found to be 84,000.
562 The first comedy at Athens acted upon a moveable scaffold.
559 Cyrus the first king of Persia.
538 The kingdom of Babylon finished; that city being

Before Christ.

ing taken by Cyrus, who, in 536, gives an edict for the return of the Jews.
534 The foundation of the temple laid by the Jews.
526 Learning is greatly encouraged at Athens, and a public library first founded.
520 The second edict to rebuild Jerusalem.
515 The second temple at Jerusalem is finished under Darius.
510 Hippias banished from Athens.
509 Tarquin, the seventh and last king of the Romans, is expelled, and Rome is governed by two consuls, and other republican magistrates, till the battle of Pharsalia, being a space of 461 years.
508 The first alliance between the Romans and Carthaginians.
507 The second census at Rome, 130,000 citizens.
504 Sardis taken and burnt by the Athenians, which gave occasion to the Persian invasion of Greece.
498 The first dictator appointed at Rome.
497 The Saturnalia instituted at Rome.
The number of citizens 150,700.
493 Tribunes created at Rome; or, in 488.
490 The battle of Marathon, September 28th.
486 Æschylus, the Greek poet, first gains the prize of tragedy.
483 Questors created at Rome.
481 Xerxes, king of Persia, begins his expedion against Greece.
480 The defence of Thermopylæ by Leonidas, and the sea-fight at Salamis.
476 The number of Roman citizens reduced to 103,000
469 The third Messenian war.
466 The number of Roman citizens increased to 124,214.
458 Ezra is sent from Babylon to Jerusalem, with the captive Jews and the vessels of gold and silver, &c. being seventy weeks of years, or 490 years before the crucifixion of our Saviour.
456 The Ludi Seculares first celebrated at Rome.
454 The Romans send to Athens for Solon's laws.
451 The Decemvirs created at Rome, and the laws of the twelve tables compiled and ratified.
449 The Decemvirs banished.
445 Military tribunes, with consular power, created at Rome.
443 Censors created at Rome.
441 The battering Ram invented by Artemones.
432 The Metonic cycle began July 15th.
431 The Peloponnesian war began, and lasted 27 years.
430 The history of the Old Testament finishes about this time.
A plague over the known world.
Malachi the last of the prophets.
405 The Athenians entirely defeated by Lysander, which occasions the loss of the city, and ruin of the Athenian power.
401 The retreat of the 10,000 Greeks under Xenophon. The 30 tyrants expelled from Athens, and democratic government restored.
400 Socrates, the founder, of moral philosophy among the Greeks, believes the immortality of the soul, a state of rewards and punishments; for which, and other sublime doctrines, he is put to death by the Athenians, who soon after repent, and erect to his memory a statue of brass.
399 The feast of Lectisternium instituted. Catapultæ invented by Dionysius.
394 The Corinthian war begun.
390 Rome burnt by the Gauls.
387 The peace of Antalcidas between the Greeks and Persians.
The number of Roman citizens amounted to 152,583.
384 Dionysius begins the Punic war.
379 The Bœtian war commences.
377 A general conspiracy of the Greek states against the Lacedemonians.
373 A great earthquake in Peloponnesus.
371 The Lacedemonians defeated by Epaminondas at Leuctra.
367 Prætors established in Rome. The Licinian law passed.
363 Epaminondas killed at the battle of Mantinea.
359 The obliquity of the ecliptic observed to be 23° 49′ 10″.
358 The Social war began.
357 Dionysius expelled from Syracuse.
A transit of the moon over Mars observed.
356 The sacred war begun in Greece.
Birth of Alexander the Great.
343 Dionysius II. expelled from Syracuse.
Commencement of the Syracusian era.
338 Philip of Macedon gains the battle of Chæronæa, and thus attains to the Sovereignty of Greece.
335 Thebes taken and rased by Alexander the Great.
334 The Persians defeated at Granicus, May 22d.
333 They are again defeated at Issus in Cilicia, October.
332 Alexander takes Tyre and marches to Jerusalem.
331 Alexandria built.
Darius entirely defeated at Arbela.
330 Alexander takes Babylon, and the principal cities of the Persian Empire.
The Calippic period commences.
328 Alexander passes Mount Caucasus, and marches into India.
327 He defeats Porus, an Indian prince, and founds several cities.
326 The famous sedition of Corcyra.
324 His family exterminated, and his dominions parted by his officers.
323 Alexander the Great dies at Babylon.
315 Rhodes almost destroyed by an inundation.
311 The Appian way, aqueducts, &c. constructed at Rome.
308 The cities of Greece recovered their liberties for a short time.
307 Antioch, Seleucia, Laodicea, and other cities, founded by Seleucus.
301 Antigonus defeated and killed at Ipsus.
299 The first barbers came from Sicily to Rome.
294 The number of effective men in Rome amounts to 270,000.
293 The first sun-dial erected at Rome by Papirius Cursor.

Before Christ.

285 Dionysius, of Alexandria, began his astronomical era on Monday June 26, being the first who found the exact solar year to consist of 365 days 5 hours and 49 minutes.
The watch-tower of Pharos at Alexandria built.
Ptolemy Philadelphus, king of Egypt, employs 72 interpreters to translate the Old Testament into the Greek languages, which is called the *Septuagint*.
284 The foundations of the Achæan republic laid.
283 The college and library founded at Alexandria.
282 The Tarentine war begins.
280 Pyrrhus invades Italy.
279 A census at Rome. The number of citizens 278,222.
269 The first coining of silver at Rome.
265 The number of Roman citizens augmented to 292,224.
264 The first Punic war begins, and continues 23 years. The Chronology of the Arundelian marbles composed.
262 A transit of Mercury over the Bull's horn; the planet being in 23° of ♉, and the sun in 29° 30′ ♈.
260 Provincial questors established at Rome.
The Romans first concern themselves in naval affairs, and defeat the Carthaginians at sea.
255 Regulus, the Roman Consul, defeated and taken prisoner by the Carthaginians under Xantippus.
252 A census at Rome. The number of citizens 297,897.
247 Another census. The number of citizens, 251,212,
246 The records of China destroyed.
241 Conclusion of the first Punic war.
240 Comedies first acted at Rome.
237 Hamilcar, the Carthaginian, causes his son Hannibal, at nine years old, to swear eternal enmity to the Romans.
236 The Tartars expelled from China.
235 Rome at peace with other nations. The temple of Janus shut.
231 Corsica and Sardinia subdued by the Romans.
The first divorce at Rome.
230 The obliquity of the ecliptic observed by Eratosthenes to be 23° 51′ 20″.
224 The Colossus at Rhodes overturned by an earthquake.
219 The art of surgery introduced at Rome.
218 Commencement of the second Punic war.
Hannibal passes the Alps and invades Italy.
216 The Romans defeated at Cannæ, May 21st.
214 Syracuse besieged by Marcellus.
209 A census at Rome. The number of citizens 227,107.
208 Asdrubal invades Italy; but is defeated and killed.
206 Gold first coined at Rome.
202 Hannibal defeated by Scipio at Zama.
201 Conclusion of the second Punic war.
194 Sparta and Hither Spain subdued by the Romans.
192 A census at Rome. The number of citizens 243,704.
191 Antiochus defeated by the Romans at Thermopylæ.
190 The first Roman army enters Asia, and from the spoils of Antiochus brings the Asiatic luxury first to Rome.
188 The Spartans obliged to renounce the institutions of Lycurgus.
179 A census at Rome. The number of citizens 273,244.
173 The Jewish high-priesthood sold by Antiochus Epiphanes.
170 Paper invented in China.
The temple of Jerusalem plundered by Antiochus.
169 A census at Rome. The number of citizens 212,805.
168 Macedon reduced to the form of a Roman province.
The first library erected at Rome.
165 The temple of Jerusalem purified by Judas Maccabeus.
164 A census at Rome. The number of citizens 327,032.
162 Hipparchus began his astronomical observations at Rhodes.
161 Philosophers and rhetoricians banished from Rome.
150 The third Punic war commenced.
146 Corinth destroyed.
Carthage, the rival to Rome, is rased to the ground by the Romans.
A remarkable comet appeared in Greece.
143 Hipparchus began his new cycle of the moon, consisting of 111,035 days.
141 The Numantine war commenced.
135 The history of the Apocrypha ends.
133 Numantia destroyed by Scipio.
124 A census at Rome. The number of citizens 390,736.
105 The Cimbri and Tuetones defeated the Romans.
102 The Tuetones and Ambrones defeated by Marius.
88 Rome besieged by the chiefs of the Marian faction.
82 Sylla created perpetual dictator at Rome.
69 A census at Rome. The number of citizens 450,000.
66 Cataline's conspiracy.
55 Julius Cæsar makes his first expedition into Britain.
Crassus defeated and killed by the Parthians.
51 Gaul reduced to a Roman province.
50 A census at Rome. The number of citizens 320,000.
48 The battle of Pharsalia, between Cæsar and Pompey, in which the latter is defeated.
The Alexandrian library, consisting of 400,000 valuable books, burnt by accident.
45 The war of Africa, in which Cato kills himself.
The solar year introduced by Cæsar.
44 Cæsar, the greatest of the Roman conquerors, after having fought fifty pitched battles, and slain 1,192,000 men, is killed in the senate-house by conspirators.
42 The republicans defeated at Philippi.
31 The battle of Actium fought, in which Mark Antony

Before Chriſt.

Anthony and Cleopatra are totally defeated by Octavius, nephew to Julius Cæſar.

30 Alexandria, in Egypt, is taken by Octavius, upon which Anthony and Cleopatra put themſelves to death, and Egypt is reduced to a Roman province.

29 A cenſus at Rome. The number of citizens 4,101,017.

27 Octavius, by a decree of the ſenate, obtains the title of Auguſtus Cæſar, and an abſolute exemption from the laws, and is properly the firſt Roman emperor.

The pantheon at Rome built.

19 Rome at the height of its glory.

The temple of Jeruſalem rebuilt by Herod.

Agrippa conſtructed the magnificent aqueducts at Rome.

8 A cenſus at Rome. The number of citizens 4,233,000.

5 The temple of Janus is ſhut by Auguſtus, as an emblem of univerſal peace, and

JESUS CHRIST is born, on Monday, December 25.

After Chriſt.

1 The Vulgar Chriſtian era commenced from January; the Saviour of the world being then five years of age.

8 Jeſus Chriſt diſputes with the doctors in the temple.

14 A cenſus at Rome, 4,037,000 citizens.

16 Mathematicians and magicians expelled from Rome.

17 Twelve cities in Aſia deſtroyed by an earthquake.

27 Pilate made governor of Judæa.

29 Jeſus baptiſed in Jordan by John.

33 He is crucified at Jeruſalem.

35 St Paul converted.

39 St Matthew writes his Goſpel.

Pontius Pilate kills himſelf.

A conjunction of Saturn, Jupiter, and Mars.

40 The name of Chriſtians firſt given at Antioch to the followers of Chriſt.

43 Claudius Cæſar's expedition into Britain.

44 St Mark writes his Goſpel.

50 London is founded by the Romans: 368, ſurrounded by ditto with a wall, ſome parts of which are ſtill obſervable.

51 Caractacus, the Britiſh king, is carried in chains to Rome.

52 The council of the Apoſtles at Jeruſalem.

55 St Luke writes his Goſpel.

56 Rotterdam built.

59 The emperor Nero puts his Mother and brothers to death.

———Perſecutes the Druids in Britain.

60 Chriſtianity introduced into Britain.

61 Boadicia, the Britiſh queen, defeats the Romans; but is conquered ſoon after by Suetonius, gogernor of Britain.

62 St. Paul is ſent in bonds to Rome—writes his epiſtles between 51 and 66.

63 The Acts of the Apoſtles written.

A great earthquake in Aſia.

64 Rome ſet on fire, and burned for ſix days; upon which began (under Nero) the firſt perſecution againſt the Chriſtians.

65 Many prodigies ſeen about Jeruſalem.

66 St Peter and St Paul put to death.

70 While the factious Jews are deſtroying one another with mutual fury, Titus, the Roman general, takes Jeruſalem, which is raſed to the ground, and the plough made to paſs over it.

73 The philoſophers baniſhed from Rome by Veſpaſian.

79 The cities of Pompeii and Herculaneum deſtroyed by an eruption of Veſuvius.

80 The Capitol and Pantheon at Rome deſtroyed by fire.

83 The philoſophers expelled Rome by Domitian.

85 Julius Agricola, governor of South-Britain, to protect the civilized Britons from the incurſions of the Caledonians, builds a line of forts between the rivers Forth and Clyde; defeats the Caledonians under Galgacus on the Grampian hills; and firſt ſails round Britain, which he diſcovers to be an iſland.

86 The Capitoline games inſtituted by Domitian.

88 The ſecular games celebrated at Rome.

93 The empire of the Huns in Tartary deſtroyed by the Chineſe.

The Evangeliſt John baniſhed to Patmos.

94 The ſecond Perſecution of the Chriſtians under Domitian.

96 St John the Evangeliſt wrote his Revelation—his Goſpel in 97.

103 Dacia reduced to a Roman province.

105 A great earthquake in Aſia and Greece.

107 The third perſecution of the Chriſtians under Trajan.

114 Armenia reduced to a Roman province.

A great earthquake in China.

115 Aſſyria ſubdued by Trajan.

An inſurrection of the Jews, who murder 200,000 Greeks and Romans.

A violent earthquake at Antioch.

120 Nicomedia and other cities ſwallowed up by an earthquake.

121 The Caledonians reconquer from the Romans all the ſouthern parts of Scotland; upon which the emperor Adrian builds a wall between Newcaſtle and Carliſle; but this alſo proving ineffectual, Pollius Urbicus, the Roman general, about the year 134, repairs Agricola's forts, which he joins by a wall four yards thick.

130 Jeruſalem rebuilt by Adrian.

132 The ſecond Jewiſh war commenced.

135 The ſecond Jewiſh war ends, when they were all baniſhed Judea.

139 Juſtin writes his firſt apology for the Chriſtians.

141 A number of hereſies appear about this time.

146 The worſhip of Serapis introduced at Rome.

152 The emperor Antoninus Pius ſtops the perſecution againſt the Chriſtians.

An inundation of the Tyber, and an earthquake at Rhodes.

163 The fourth perſecution of the Chriſtians, under Marcus Aurelius Antoninus.

166 The Romans ſent Ambaſſadors to China.

After Christ.

168 A plague over the known world.
188 The Capitol at Rome destroyed by lightning.
191 A great part of Rome destroyed by fire.
203 The fifth persecution of the Christians, under Severus.
205 An earthquake in Wales.
209 Severus's wall in Britain built.
218 Two comets appeared at Rome. The course of the most remarkable from east to west.
222 About this time the Roman empire begins to decline. The Barbarians begin their irruptions, and the Goths have annual tribute not to molest the empire.
225 Mathematicians allowed to teach publicly at Rome.
236 The sixth persecution of the Christians, under Maximin.
241 The Franks first mentioned in history.
250 The seventh persecution, under Decius.
252 A dreadful pestilence broke out in Ethiopia, and spread over the world.
The eighth persecution, under Gallus.
253 Europe ravaged by the Scythians and Goths.
258 The ninth persecution, under Valerian.
260 Valerian is taken prisoner by Sapor, king of Persia, and flead alive.
The Scythians ravaged the Roman empire
The temple of Diana at Ephesus burnt.
261 A great plague throughout the Roman empire.
262 Earthquakes in Europe, Asia, and Africa, and three days of darkness.
273 The Romans took Palmyra.
274 Silk first brought from India; the manufactory of it introduced into Europe by some monks, 551; first worn by the clergy in England, 1534.
276 Wines first made in Britain.
277 The Franks settled in Gaul.
284 The Dioclesian era commenced august 29th, or September 17th.
287 Carausius proclaimed emperor of Britain.
289 A great comet visible in Mesopotamia for 29 days.
291 Two emperors and two Cæsars march to defend the four quarters of the empire.
297 Alexandria destroyed by Dioclesian.
303 The tenth persecution, under Dioclesian.
306 Constantine the Great begins his reign.
308 Cardinals first began.
312 Pestilence all over the East.
Cycle of induction began.
313 The tenth persecution ends by an edict of Constantine, who favours the Christians, and gives full liberty to their religion.
314 Three bishops, or fathers, are sent from Britain to assist at the council of Arles.
315 Crucifixion abolished.
321 Observation of Sunday enjoined.
323 The first general council at Nice, when 318 fathers attended, against Arius, the founder of Arianism, where was composed the famous Nicene Creed, which we attribute to them.
328 Constantine removes the seat of empire from Rome to Byzantium, which is thereafter called Constantinople.
330 A dreadful persecution of the Christians in Persia, which lasts 40 years.
331 Constantine orders all the heathen temples to be destroyed.
334 300,000 Sarmatians revolted from their masters.
341 The gospel propagated in Ethiopia by Foumentius.
344 Neocæsarea ruined by an earthquake.
351 The heathens first called Pagans.
358 An hundred and fifty cities in Asia and Greece overturned by an earthquake.
360 The first monastery founded near Poictiers in France, by Martin.
363 The Roman emperor Julian, surnamed the Apostate, endeavours in vain to rebuild the temple of Jerusalem.
364 The Roman empire is divided into the eastern (Constantinople the capital) and western (of which Rome continued to be the capital), each being now under the government of different emperors.
373 The Bible translated into the Gothic language.
376 The Goths settled in Thrace.
379 The cycle of Theophilus commenced.
390 A fiery column seen in the air for 30 days.
400 Bells invented by bishop Paulinus, of Campagnia.
401 Europe over-run by the Goths under Alaric.
404 Another irruption of the Goths.
The kingdom of Caledonia or Scotland revives under Fergus.
406 Third irruption of the Goths.
The Vandals, Alans, and Suevi, spread into France and Spain, by a concession of Honorius, emperor of the West.
408 The Christian religion propagated in Persia.
409 Rome taken and plundered by the Goths, August 24th.
412 The Vandals begin their kingdom in Spain.
413 The kingdom of Burgundy begun in Alsace.
414 The kingdom of Thoulouse founded by the Visigoths.
417 The Alans extirpated by the Goths.
419 Many cities in Palestine destroyed by an earthquake.
420 The kingdom of France begins upon the Lower Rhine, under Pharamond.
421 The Salique law promulgated.
426 The Romans, reduced to extremities at home, withdraw their troops from Britain, and never return; advising the Britons to arm in their own defence, and trust to their own valour.
432 The gospel preached in Ireland by St Patrick.
444 All Europe ravaged by the Huns.
446 The Britons now left to themselves, are greatly harassed by the Scots and Picts, upon which they once more make their complaint to the Romans (which they intitle, *The Groans of the Britons*), but receive no assistance from that quarter.
447 Attila (surnamed the Scourge of God) with his Huns ravage the Roman empire.
449 Vortigern, king of the Britons, invites the Saxons into Britain, against the Scots and Picts.

After Christ.

452 The city of Venice founded.
455 The Saxons having repulsed the Scots and Picts, invite over more of their countrymen, and begin to establish themselves in Kent, under Hengist.
476 The western empire is finished, 523 years after the battle of Pharsalia; upon the ruins of which several new states arise in Italy and other parts, consisting of Goths, Vandals, Huns, and other barbarians, under whom literature is extinguished, and the works of the learned are destroyed.
480 A great earthquake at Constantinople, which lasted 40 days.
493 Italy reduced by Theodoric king of the Goths.
496 Clovis, king of France, baptized, and Christianity begins in that kingdom.
506 The Jewish talmud published
508 Prince Arthur begins his reign over the Britons.
510 Paris made the capital of the French dominions.
515 Constantinople besieged by Vitalianus, whose fleet is burnt by a speculum of brass made by Proclus.
516 The computing of time by the Christian era is introduced by Dionysius the monk.
517 Five years drought and famine in Palestine.
519 A bearded comit appears.
529 The codex of Justinian, the eastern emperor, is published.
534 The kingdom of the Vandals in Africa comes to an end, after having continued 105 years.
536 The manufacture of silk introduced at Constantinople by two Indian monks.
540 Antioch destroyed by the Persians.
541 Basilius the last consul elected at Rome.
542 Antioch rebuilt.
543 An earthquake all over the world.
550 An earthquake in Palestine and Syria.
The kingdom of Poland founded.
551 An earthquake in Greece, attended with a great commotion in the sea.
553 The empire of the Goths in Italy destroyed by Narses.
A great earthquake at Constantinople.
557 Another violent earthquake at Constantinople, Rome, &c.
A terrible plague all over Europe, Asia, and Africa, which continues near fifty years.
568 The Lombards founded a kingdom in Italy.
569 The Turks first mentioned in history.
The exarchate of Ravenna begins.
575 The first monarchy founded in Bavaria.
580 Antioch destroyed by an earthquake.
581 Latin ceased to be spoken about this time in Italy.
584 The origin of fiefs in France.
588 The city of Paris destroyed by fire.
589 Rome overflowed by the Tiber.
593 The Gascons established themselves in the country called by their name.
596 John of Constantinople assumes the title of universal bishop.
597 Augustin the monk comes into England with forty monks.
599 A dreadful pestilence in Africa.
604 St Paul's church in London founded.
605 The use of bells introduced into churches.
606 Here begins the power of the popes, by the concessions of Phocas, emperor of the East.
622 Mahomet, the false prophet, flies from Mecca to Medina, in Arabia, in the 44th year of his age, and 10th of his ministry, when he laid the foundation of the Saracen empire, and from whom the Mahometan princes to this day claim their descent. His followers compute their time from this era, which in Arabic is called *hegira*, i. e. "the Flight."
628 An academy founded at Canterbury.
632 The era of Jesdegird commenced June 16 th.
637 Jerusalem is taken by the Saracens or followers of Mahomet.
641 Alexandria in Egypt is taken by ditto, and the grand library there burnt by order of Omar their caliph or prince.
643 The temple of Jerusalem converted into a Mahometan mosque.
653 The Saracens now extend their conquests on every side, and retaliate the barbarities of the Goths and Vandals upon their posterity.
They take Rhodes, and destroy the famous Colossus.
England invaded by the Danes.
660 Organs first used in churches.
663 Glass invented by a bishop, and brought into England by a Benedictine monk.
669 Sicily invaded, and Syracuse destroyed by the Saracens.
685 The Britons, after a brave struggle of near 150 years, are totally expelled by the Saxons, and driven into Wales and Cornwall.
698 The Saracens take Carthage, and expel the Romans from Africa.
700 Cracow built, and the first prince of Poland elected.
704 The first province given to the Pope.
713 The Saracens conquer Spain.
714 France governed by Charles Martel.
718 The kindom of the Asturias in Spain founded by Pelagio.
719 Christianity promulgated in Germany.
726 The controversy about images begins, and occasions many insurrections in the eastern empire.
727 Tax of Peter's pence begun by Ina king of Wessex.
732 Charles Martel defeats the Saracens near Tours.
735 Institution of the office of Pope's Nuncio.
746 Three years pestilence in Europe and Asia.
748 The computing of years from the birth of Christ began to be used in history.
749 The race of Abbas become caliphs of the Saracens, and encourage learning.
The empire of the Saracens divided into three.
752 The exarchate of Ravenna abolished by Astolphus king of the Lombards.
755 Commencement of the Pope's temporal dominion.
762 The city of Bagdad upon the Tigris, is made the capital for the caliphs of the house of Abbas.

After Christ.

762 Burials, which formerly used to be in highways, permitted in towns.
792 An academy founded in Paris.
794 The Huns extirpated by Charlemagne.
797 Seventeen days of unusual darkness.
800 Charlemagne, king of France, begins the empire of Germany, afterwards called the western empire; gives the present names to the winds and months; endeavours to restore learning in Europe, but mankind are not yet disposed for it, being solely engrossed in military enterprises.
801 A great earthquake in France, Germany, and Italy.
807 Jan. 31. Jupiter eclipsed by the moon. March 17. A large spot seen on the sun for eight days.
808 The first descent of the Normans on France.
825 The obliquity of the ecliptic observed by Benimula to be 23° 55′.
826 Harold, king of Denmark, dethroned by his subjects for being a Christian.
The kingdoms of Navarre and Arragon founded.
832 Painters banished out of the eastern empire.
836 The Flemings trade to Scotland for fish.
840 The Scots and Picts have a decisive battle, in which the former prevail, and both kingdoms are united by Kenneth, which begins the second period of the Scottish history.
842 Germany separated from the empire of the Franks.
856 An earthquake over the greatest part of the known world.
861 Ruric the first prince of Russia began to reign.
864 The Danes begin their ravages in England.
867 Christianity propagated in Bulgaria.
868 Egypt becomes independent on the caliphs of Bagdad.
872 Bells and clocks first used in Constantinople.
873 France distressed by locusts and pestilence.
874 Iceland peopled by the Norwegians.
Scotland invaded by the Danes.
875 A bearded comet appears in France.
878 Alfred the Great, after subduing the Danish invaders (against whom he fought 56 battles by sea and land), composes his body of laws; divides England into counties, hundreds, tythings; in 890 erects county-courts, having founded the university of Oxford in 886.
880 The obliquity of the ecliptic observed by Albategni to be 23° 35′.
886 The Hungarians settled near the Danube.
891 The first land-tax in England.
895 The monastery of Cluny founded.
905 A very remarkable comet appeared in China. Rome taken by the Normans.
911. The obliquity of the ecliptic observed by Thebit to be 23° 33′ 30″.
912 The Normans establish themselves in Normandy.
913 The Danes become masters of England.
915 The university of Cambridge founded.
923 Fiefs established in France.
925 Sigefroi elected first marquis of Brandenburgh.
928 The marquisate of Misnia established.
937 The Saracen empire is divided by usurpation into seven kingdoms.
941 Arithmetic brought into Europe.
961 Candia recovered from the Saracens.
967 Antioch recovered from the Saracens.
969 The race of Abbas extinguished in Egypt.
975 Pope Boniface VII. is deposed and banished for his crimes.
977 Greece, Macedon, and Thrace, ravaged by the Bulgarians for ten years.
The Bohemians subdued by Otho.
979 Coronation oath first used in England.
Juries first instituted into ditto.
985 The danes under Sueno invaded England and Scotland.
987 The Carlovingian race in France ended.
991 The figures in arithmetic are brought into Europe by the Saracens from Arabia; letters of the alphabet were hitherto used.
993 A great eruption of Mount Vesuvius.
995 England invaded by the Danes and Norwegians.
996 Otho III. makes the empire of Germany elective.
999 Boleslaus, the first king of Poland.
The obliquity of the ecliptic observed by Aboul-Wasi and Abu Hamed to be 23° 35′.
1000 Paper made of cotton rags was in use; that linen rags in 1170: the manufactory introduced into England at Deptford, 1588.
1002 The emperor Henry assumed the title of king of the Romans.
1005 All the old churches are rebuilt about this time in a new manner of architecture.
1006 A plague in Europe for three years.
1007 A great eruption of Vesuvius.
The obliquity of the ecliptic observed by Albatrunius to be 23° 35′.
1014 Sueno the Dane becomes master of England.
Sept. 28. Almost all Flanders laid under water by a storm.
1015 Children forbidden by law to be sold by their parents in England.
1017 Rain of the colour of blood for three days in Aquitain.
1022 A new species of music invented by Aretin.
1035 Togrul-Beg, or Tangrolipix, the Turkish sultan, establishes himself in Korasan.
The kingdoms of Castile and Arragon began.
1040 The Danes, after several engagements with various success, are about this time driven out of Scotland, and never again return in a hostile manner.
Smyrna destroyed by an earthquake.
1041 The Saxon line restored under Edward the Confessor.
1043 The Turks become formidable and take possession of Persia.
The Russians come from Scythia, and land in Thrace.
1054 Leo IX, the first pope that kept up an army.
1055 The Turks take Bagdad, and overturn the empire of the Saracens.
1057 Malcolm III, king of Scotland, kills the tyrant Macbeth at Dunsinnan, and marries the princess Margaret, sister to Edgar Atheling.

After Christ.

1061 Surnames appointed to be taken in Scotland by a parliament held in Forfar.
1065 The Turks take Jerusalem from the Saracens.
1066 The conquest of England by William (surnamed the Bastard) duke of Normandy, in the battle of Hastings, where Harold is slain.
1070 The feudal law introduced into England.
1075 Henry IV. emperor of Germany, and the pope, quarrel about the nomination of the German bishops. Henry, in penance, walks barefooted to the pope towards the end of January.
1076 Justices of the peace first appointed in England.
An earthquake in England.
Asia Minor, having been two years under the power of Solyman, is from this time called Turky.
1080 Doomsday-book began to be compiled by order of William, from a survey of all the estates in England, and finished in 1086.
The Tower of London built by ditto, to curb his English subjects; numbers of whom fly to Scotland, where they introduce the Saxon or English language, are protected by Malcolm, and have lands given them.
1086 The order of Carthusians established by Bruno.
1090 The dynasty of Bathineens or Assassins begins in Irak, and continues for 117 years.
1091 The Saracens in Spain, being hard pressed by the Spaniards, call to their assistance Joseph king of Morocco; by which the Moors get possession of all the Saracen dominions in Spain.
1096 The first crusade to the Holy Land is begun under several Christian princes, to drive the infidels from Jerusalem.
1098 The order of St Benedict instituted.
1099 Jerusalem taken by the crusaders; Godfrey elected king of it; and the order of knights of St John instituted.
1110 Edgar Atheling, the last of the Saxon princes, dies in England, where he had been permitted to reside as a subject.
Learning revived at Cambridge.
Writing on paper made of cotton common about this time.
1118 The order of the knights Templars instituted, to defend the Sepulchre at Jerusalem, and to protect Christian strangers.
1119 Bohemia erected into a kingdom.
1132 The kingdom of Portugal began.
1137 The pandect of Justinian found in the ruins of Amalphi.
1141 The factions of the Guelphs and Gibellines prevailed about this time.
1143 The Koran translated into Latin.
1144 The Peripatetic philosophy introduced into Germany.
1151 The canon law collected by Gratian, a monk of Bologna.
1154 Christianity introduced into Finland.
1156 The city of Moscow in Russia founded.
1160 The order of the Carmelites instituted.
1163 London bridge, consisting of 19 small arches, first built of stone.
1164 The teutonic order of religious knights begins in Germany.
1171 The dynasty of Fatemites ended in Egypt; the sovereigns of this country henceforth called Sultans.
1172 Henry II. king of England (and first of the Plantagenets), takes possession of Ireland; which, from that period, has been governed by an English viceroy, or lord lieutenant.
1176 England is divided by Henry into six circuits, and justice is dispensed by itinerant judges.
1179 The university of Padua founded.
1180 Glass windows began to be used in private houses in England.
1181 The laws of England are digested about this time by Glanville.
1182 Pope Alexander III. compelled the kings of England and France to hold the stirrups of his saddle when he mounted his horse.
1183 7000 Albigenses massacred by the inhabitants of Berry.
1186 A conjunction of all the planets at sunrise September 16. The Sun in 30° ♍; Jupiter in 2° 3′ ♎; Venus in 3° 49′; Saturn in 8° 6′; Mercury in 4° 10′; Mars, 9° 8′; tail of the Dragon, 18° 23′ ♎.
1187 Jerusalem taken by Saladin.
1192 The battle of Ascalon, in Judea, in which Richard, king of England, defeates Saladin's army, consisting of 300,000 combatants.
1194 *Dieu et mon Droit*, first used as a motto by Richard, on a victory over the French.
1195 Denmark and Norway laid waste by a dreadful tempest.
1198 Institution of the order of the Holy Trinity.
1200 Chimnies were not known in England.
Surnames now began to be used; first among the nobility.
University of Salamanca in Spain founded.
1204 Constantinople taken by the French and Venetians.
The Inquisition established.
The empire of Trebizond established.
1208 London incorporated, and obtained their first charter for electing their Lord Mayor and other magistrates from king John.
The order of *Fratres Minores* established.
The pope excommunicates king John.
1209 The works of Aristotle imported from Constantinople into Europe.
The silk manufacture imported from Greece into Venice.
1210 The works of Aristotle condemned to be burnt at Paris.
The emperor Otho excommunicated by the pope.
Violent persecution of the Albigenses.
1215 Magna Charta is signed by king John and the barons of England.
Court of common pleas established.
Orders of the Dominicans and Knights Hospitallers founded.
The doctrine of transubstantiation introduced.
1216 King Alexander and the whole kingdom of Scotland

Scotland excommunicated by the pope's legate.
1220 Astronomy and geography brought into Europe by the Moors.
1222 A great earthquake in Germany.
1223 A comet of extraordinary magnitude appeared in Denmark.
1226 A league formed against the Albigenses by the French king and many prelates and lords.
1227 The Tartars, under Gingis-Kan, emerge from the northern parts of Asia, over-run all the Saracen empire, and carry death and desolation wherever they march.
1228 The university of Thoulouse founded.
1230 The kingdom of Denmark distressed by pestilence.
The kingdoms of Leon and Castile united.
Prussia subdued by the Teutonic knights.
University of Naples founded.
1231 The Almagest of Ptolemy translated into Latin.
1233 The Inquisition, begun in 1204, is now trusted to the Dominicans.
The houses of London, and other cities in England, France, and Germany, still thatched with straw.
1238 The university of Vienna founded.
1239 A writing of this year's date on paper made of rags still extant.
1241 The Hanseatic league formed.
Tin mines discovered in Germany.
1245 A clear red star, like Mars, appears in Capricorn.
1250 Painting revived in Florence by Cimabue.
1251 Wales subdued, and Magna Charta confirmed.
1253 The famous astronomical tables are composed by Alonso king of Castile.
1256 The order of the Augustines established.
1258 The Tartars take Bagdad, which finishes the empire of the Saracens.
1260 The sect of Flagellantes appeared in Italy.
1263 Acho king of Norway invades Scotland with 160 sail, and lands 20,000 men at the mouth of the Clyde; but they are cut to pieces by Alexander III. who recovers the western isles.
1264 The commons of England first summoned to parliament about this time.
1268 The Tartars invade China.
1269 The Hamburgh company incorporated in England.
The obliquity of the ecliptic observed by Cozah Nasirodni to be 23° 30'.
1272 The academy of Florence founded.
1273 The empire of the present Austrian family begins in Germany.
The obliquity of the ecliptic observed by Cheou-king in China to be 23° 33' 39".
1274 The first commercial treaty betwixt England and Flanders.
1279 King Edward renounced his right to Normandy.
The mortmain act passed in England.
1282 Lewellyn, prince of Wales, defeated and killed by Edward I. who unites that principality to England.
A great pestilence in Denmark.
8000 French murdered at the Sicilian vespers.
Academy de la Crusca founded.
1284 Edward II. born at Caernarvon, is the first prince of Wales.
1285 Alexander III. king of Scotland, dies, and that kingdom is disputed by twelve candidates, who submit their claims to the arbitration of Edward king of England; which lays the foundation of a long and desolating war between both nations.
1290 The university of Lisbon founded.
1291 Ptolemais taken by the Turks. End of the crusades.
1293 There is a regular succession of English parliaments from this year, being the 22d of Edward I.
1294 Parliaments established in Paris.
1298 The present Turkish empire begins in Bithynia under Ottoman.
Silver-hafted knives, spoons, and cups, a great luxury.
Tallow candles so great a luxury, that splinters of wood were used for lights.
Wine sold by apothecaries as a cordial.
The Scots defeated by the English at Falkirk.
1299 An earthquake in Germany.
Spectacles invented by a monk of Pisa.
The year of jubilee instituted by Boniface VIII.
1302 The mariner's compass invented, or improved, by Giovia, of Naples.
The university of Avignon founded.
1307 The beginning of the Swiss cantons.
Coal first used in England.
1308 The popes remove to Avignon in France for 70 years.
1310 Lincoln's inn society established.
The knights of St John take possession of the isle of Rhodes.
1314 The battle of Bannockburn, between Edward II. and Robert Bruce, which establishes the latter on the throne of Scotland.
The cardinals set fire to the conclave and separate, A vacancy in the papal chair for two years.
1315 Germany afflicted with famine and pestilence.
1319 The university of Dublin founded.
1320 Gold first coined in Christendom; 1344 ditto in England.
An earthquake in England.
1323 A great eruption of Mount Ætna.
1325 The first treaty of commerce betwixt England and Venice.
1330 Gunpowder invented by a monk of Cologne.
1332 The pope accused of heresy.
1336 Two Brabant weavers settle at York, which, says Edward III. may prove of great benefit to us and our subjects.
1337 The first comet whose course is described with an astronomical exactness.
Europe infested by locusts.
1340 Heralds college instituted in England.
Copper-money first used in Scotland and Ireland.
1344 The first creation to titles by patents used by Edward III.
1345 Edward III. has four pieces of cannon, which gained him the battle of Cressy.
1347 The battle of Durham, in which David, king of Scots, is taken, prisoner.

After Christ.

1349 The order of the Garter instituted in England by Edward III. altered in 1557, and consists of 26 knights.
1352 The Turks first enter Europe.
1353 Asia and Africa desolated by locusts.
1354 The money in Scotland till now the same as in England.
1356 The battle of Poictiers, in which king John of France and his son are taken prisoners by Edward the Black Prince.
1357 Coals first brought to London.
1358 Arms of England and France first quartered by Edward III.
University of Cologne founded.
Tamerlane began to reign in Persia.
1362 The law pleadings in England changed from French to English as a favour of Edward III. to his people.
The military order of Janizaries established among the Turks.
1365 The universities of Vienna and Geneva founded
1369 John Wickliffe an Englishman begins to call in question the doctrines of the church of Rome about this time, whose followers are called Lollards.
1370 The office of Grand vizir established.
1377 Inundation of the sea in Flanders.
1378 Greenland discovered by a Venetian.
1381 Bills of Exchange first used in England.
1384 The first act of navigation in England; no goods to be exported or imported by Englishmen in foreign bottoms.
1386 A company of linen weavers from the Netherlands established in London.
Windsor castle built by Edward III.
1387 The first Lord High Admiral of England instituted.
1388 The battle of Otterburn between Hotspur and the earl of Douglas.
Bombs invented at Venloo.
1391 Cards invented in France for the king's amusement.
1399 Westminster abbey rebuilt and enlarged—Westminster hall ditto.
Order of the bath instituted at the coronation of Henry IV. renewed in 1725; consisting of 38 knights.
1402 Tamerlane defeats and takes prisoner Bajazet the Turkish sultan.
1405 The Canary islands discovered by Bathencourt a Norman.
1410 Guildhall, London, built.
Painting in oil-colours invented at Bruges by John Van-eyck.
1411 The university of St Andrew's in Scotland founded.
1412 Algebra brought from Arabia into Europe.
1415 The battle of Agincourt gained over the French by Henry V. of England.
1420 The island of Madeira discovered by the Portuguese.
1421 The revenue of England amounted to L. 55,754.
1428 The siege of Orleans, the first blow to the English power in France.
1431 A great eathquake at Lisbon.
1432 Great inundations in Germany.
1437 The obliquity of the ecliptic observed by Ulug Beg to be 23° 30′ 17″.
1440 Printing invented by L. Koster at Haerlam in Holland; brought into England by W. Caxton, a mercer of London, 1471.
1446 The Vatican library founded at Rome.
The sea breaks in at Dort in Holland, and drowns 100,000 people.
1453 Constantinople taken by the Turks, which ends the eastern empire, 1123 years from its dedication by Constantine the great, and 2206 years from the foundation of Rome.
1454 The university of Glasgow in Scotland founded.
1457 Glass first manufactured in England.
1460 Engraving and etching on copper invented.
The obliquity of the ecliptic observed by Purbachius and Regiomontanus to be 23° 29′.
1473 The study of the Greek language introduced into France.
1477 The university of Aberdeen in Scotland founded.
1479 Union of the kingdoms of Arragon and Castile.
1482 The coast of Guinea discovered by the Portuguese.
A court of Inquisition erected in Seville.
1483 Richard III. king of England and last of the Plantagenets, is defeated and killed at the battle of Bosworth, by Henry (Tudor) VII. which puts an end to the civil wars between the houses of York and Lancaster, after a contest of 30 years, and the loss of 100,000 men.
1486 Henry establishes fifty yeomen of the guards, the first standing army.
1489 Maps and sea charts first brought to England by Barth. Columbus.
1490 William Groceyn introduces the study of the Greek language into England.
The Moors, hitherto a formidable enemy to the native Spaniards, are entirely subdued by Ferdinand, and become subjects to that prince on certain conditions, which are ill observed by the Spaniards, whose clergy use the Inquisition in all its tortures; and in 1609, near one million of the Moors are driven from Spain to the opposite coast of Africa, from whence they originally came.
1492 America first discovered by Columbus, a Genoese in the service of Spain.
The Moors expelled from Granada, which they had possessed upwards of 800 years.
1495 The venereal disease introduced into Europe.
1496 The Jews and Moors banished out of Portugal.
1497 The Portuguese first sail to the East Indies by the Cape of Good Hope.
South America discovered by Americus Vespusius, from whom it has its name.
1499 North America discovered, for Henry VII. by Cabot a Venetian.
1500 Maximilian divides the empire of Germany into six circles, and adds four more in 1512.
Brazil discovered by the Portuguese. Florida discovered by John Cabot, an Englishman.
Painting in chiaro obscuro discovered.
A great plague in England.
1505 Shillings first coined in England.

1507 The island of Madagascar discovered by the Portuguese.
1509 Gardening introduced into England from the Netherlands, from whence vegetables were imported hitherto.
1510 The obliquity of the ecliptic observed by Wernenus to be 23° 28′ 30″.
1513 The battle of Flowden, in which James IV. king of Scotland is killed, with the flower of his nobility.
1514 Cannon bullets of stone still in use.
1515 The first Polyglot Bible printed at Alcala.
The kingdom of Navarre annexed to that of Castile by Ferdinand.
1516 The kingdom of Algiers seized by Barbarossa.
1517 Martin Luther began the Reformation.
Egypt is conquered by the Turks.
The kingdom of the Mamalukes in Egypt overthrown by the Turks.
1518 Discovery of New Spain, and the Straits of Magellan.
1521 Henry VII. for his writings in favour of popery, receives the title of Defender of the Faith from his Holiness.
1522 Rhodes taken by the Turks.
The first voyage round the world performed by a ship of Magellan's squadron.
1526 The inquisition established in Portugal.
Lutheranism established in Germany.
1527 Rome taken and plundered by the Imperial army.
1528 Popery abolished in Sweden.
1529 The name of Protestant takes its rise from the reformed protesting against the church of Rome, at the diet of Spires in Germany.
1530 Union of the Protestants at Smallcalde, December 22d.
Secretary of State's office established in England.
1531 A great earthquake at Lisbon.
1532 The Court of Session instituted in Scotland.
1533 Insurrection of the Anabaptists in Westphalia.
1534 The reformation takes place in England, under Henry VIII.
Barbarossa seized on the kingdom of Tunis.
1535 The Reformation introduced into Ireland.
The society of Jesuits formed.
1539 The first English edition of the Bible authorised; the present translation finished 1611.
About this time cannon began to be used in ships.
Six hundred and forty-five religious houses suppressed in England and Wales.
1540 The variation of the compass discovered by Sebastian Cabot.
The obliquity of the ecliptic observed by Copernicus to be 23° 28′ 8″.
Society of the Jesuits established, September 27.
1543 Silk stockings first worn by the French king; first worn in England by queen Eliz. 1561; the steel frame for weaving invented by the Rev. Mr Lee, of St John's College, Cambridge, 1589.
Pins first used in England, before which time the ladies used skewers.
Iron cannon and mortars made in England.
1544 Good lands let in England at one shilling per acre.
1545 The famous council of Trent begins, and continues 18 years.
1547 First law in England establishing the interest of money at 10 *per cent.*
1548 The Reformation gained ground in Poland.
1549 Lords lieutenants of counties instituted in England.
1550 Horse guards instituted in England.
The bank of Venice established about this time.
1552 Books of geography and astronomy destroyed in England, as being infected with magic.
The book of Common Prayer established in England by act of Parliament.
1554 The kingdom of Astracan conquered by the Russians.
1555 The Russian company established in England.
1558 Queen Elizabeth begins her reign.
1560 The reformation in Scotland completed by John Knox.
1561 Livonia ceded to Poland.
1563 Knives first made in England.
1565 Revolt of the Low Countries.
Malta attacked by the Turks.
1566 The 39 articles of the church of England established.
1568 Queen Mary imprisoned in England.
Liberty of exercising the reformed religion granted to the Low Countries.
2569 Royal Exchange first built.
1571 The island of Cyprus taken by the Turks.
They are defeated at Lepanto.
1572 The great massacre of Protestants at Paris.
A new star in Cassiopæia observed by Cornelius Gemma. It appeared in November, and disappeared in March.
1576 The exercise of the Protestant religion authorised in France. This toleration followed by a civil war.
1578 The first treaty of alliance betwixt England and the States General, January 7th.
1579 The Dutch shake off the Spanish yoke, and the republic of Holland begins.
English East-India company incorporated—established 1600.
——Turkey company incorporated.
1580 Sir Francis Drake returns from his voyage round the world, being the first English circumnavigator.
Parochial register first appointed in England.
The kingdom of Portugal seized by Philip of Spain.
1581 Copper money first used in France.
1582 Pope Gregory introduces the New Stile in Italy; the 5th of October being counted 15.
1583 Tobacco first brought from Virginia into England.
The first proposal of settling a colony in America.
1587 Mary queen of Scots is beheaded by order of Elizabeth, after 18 years imprisonment.
1588 The Spanish Armada destroyed by Drake and other English admirals.
Henry IV. passes the edict of Nantes, tolerating the Protestants.

After Christ.

1588 Duelling with small swords introduced into England.

1589 Coaches first introduced into England; hackney act 1693; increased to 1000 in 1770.

1590 Band of pensioners instituted in England.
Telescopes invented by Jansen, a spectacle maker in Germany.

1591 Trinity college, Dublin, founded.

1593 A great plague in London.

1594 The Jesuits expelled from France.
The obliquity of the ecliptic observed by Bygius to be 23° 30′.

1595 The same observed by Tycho-Brache to be 23° 29′ 25″.

1596 A great earthquake at Japan.

1597 Watches first brought into England from Germany.

1598 The edict of Nantes by Henry IV. of France.

1602 Decimal arithmetic invented at Bruges.

1603 Queen Elizabeth (the last of the Tudors) dies, and nominates James VI. of Scotland as her successor; which unites both kingdoms under the name of Great Britain.

1605 The Gun-powder-plot discovered at Westminster; being a plot to blow up the king and both houses of Parliament.

1606 Oaths of allegiance first administered in England.

1608 Colonies sent from England to Virginia.

1609 The independency of the United States acknowledged by Spain.

1610 Galileo, of Florence, first discovers the satellites about the planet Jupiter, by the telescope lately invented in Germany.
Henry IV. is murdered at Paris by Ravaillac a priest.
Thermometers invented by Diebel, a Dutchman.

1611 Baronets first created in England by James I. May 22.
An earthquake at Constantinople; 200,000 persons died there of the plague.

1612 The north-west passage to China attempted in vain by the English.

1614 Napier of Marcheston, in Scotland, invents the logarithms.
Sir Hugh Middleton brings the new river to London from Ware.

1616 The first permanent settlement in Virginia.

1619 W. Harvey, an Englishman, confirms the doctrine of the circulation of the blood, which had been first broached by Servetius, a French physician, in 1553.

1620 The broad silk manufacture from raw silk, introduced into England.
Barbadoes discovered by Sir William Courteen.
Navarre united to France.
Copper-money first introduced in England.

1621 New England planted by the Puritans.
The two parties of Whigs and Tories formed in England.

1622 The Palatinate reduced by the Imperialists.

1623 The knights of Nova Scotia instituted.

1624 Massacre of the English at Amboyna.

1625 King James dies, and is succeeded by his son Charles I.

1625 The island of Barbadoes, the first English settlement in the West Indies, is planted.

1631 The transit of Mercury over the sun's disk, first observed by Gassendi.
A great eruption of Vesuvius.

1632 The battle of Lutzen, in which Gustavus Adolphus, king of Sweden, and head of the Protestants in Germany, is killed.

1633 Galileo condemned by the inquisition at Rome.
Louisiana discovered by the French.

1635 Province of Maryland planted by lord Baltimore.
Regular posts established from London to Scotland, Ireland, &c.

1636 A transit of Mercury over the Sun's disk observed by Cassini.

1639 A transit of Venus over the sun's disk first observed by Mr Horrox, November 24th. O. S. 3 h 15′ P. M.

1640 King Charles disobliges his Scottish subjects: on which their army, under general Lesley, enters England, and takes Newcastle, being encouraged by the malecontents in England.
The massacre in Ireland, when 40,000 English Protestants were killed.
The independency of Portugal recovered by John duke of Braganza.

1642 King Charles impeaches five refractory members, which begins the civil wars in England.

1643 Excise on beer, ale, &c. first imposed by parliament.
Barometers invented by Torricelli.

1648 A new star observed in the tale of the Whale by Fabricius.

1649 Charles I. beheaded by Cromwell at Whitehall, January 30, aged 49.
Pendulums first applied to clocks by Huygens.

1651 The sect called *Quakers* appeared in England.

1652 The Dutch colony at the Cape of Good Hope established.

1654 Cromwell assumes the protectorship.
The air-pump invented by Otto Guericke of Magdeburg.

1655 The English, under Admiral Penn, take Jamaica from the Spaniards.
One of Saturn's satellites observed by Huygens.

1658 Cromwell dies, and is succeeded in the protectorship by his son Richard.

1660 King Charles II. is restored by Monk, commander of the army, after an exile of twelve years in France and Holland.
The people of Denmark, being oppressed by the nobles, surrender their privileges to Frederic III. who becomes absolute.

1661 The obliquity of the ecliptic observed by Hevelius to be 23° 29′ 7″.

1662 The Royal Society established at London by Charles II.

1663 Carolina planted; 1728, divided into separate governments.
Prussia declared independent of Poland.

1664 The New Netherlands in North America conquered from the Swedes and Dutch by the English.

After Christ.

1665 The plague rages in London, and carries off 68,000 persons.
The magic lanthorn invented by Kircher.

1666 The great fire of London began Sept. 2. and continued three days, in which were destroyed 13,000 houses and 400 streets.
Tea first used in England.

1667 The peace of Breda, which confirms to the English the New Netherlands, now the States of Pennsylvania, New York, and New Jersey.

1668 ——ditto Aix la Chapelle.
St James's park planted, and made a thoroughfare for public use by Charles II.

1669 The island of Candia taken by the Turks.

1670 The English Hudson's Bay company incorporated.
The obliquity of the ecliptic observed by Mengoli to be 23° 28′ 24″.

1672 Louis XIV. over-runs great part of Holland, when the Dutch opened their sluices, being determined to drown their country, and retire to their settlements in the East Indies.
African company established.
The obliquity of the ecliptic observed by Richer to be 23° 28′ 54″.

1677 The micrometer invented by Kircher.

1678 The peace of Nimeguen.
The habeas corpus act passed.
A strange darkness at noon-day, Jan. 12.

1680 A great comet appeared, and from its nearness to our earth alarmed the inhabitants. It continued visible from Nov. 3. to March 9.
William Penn, a Quaker, receives a charter for planting Pennsylvania.

1683 India stock sold from 360 to 500 *per cent.*

1685 Charles II. dies, aged 55, and is succeeded by his brother James II.
The duke of Monmouth, natural son to Charles II. raises a rebellion, but is defeated at the battle of Sedgmore, and beheaded.
The edict of Nantes is revoked by Louis XIV. and the Protestants are greatly distressed.

1686 The Newtonian philosophy published.

1687 The palace of Versailles, near Paris, finished by Louis XIV.

1688 The Revolution in Great Britain begins Nov. 5. King James abdicates, and retires to France, Dec. 3.
King William and Queen Mary, daughter and son-in-law to James, are proclaimed February 16.
Viscount Dundee stands out for James in Scotland, but is killed by general Mackay at the battle of Killycrankie; upon which the Highlanders, wearied with repeated misfortunes, disperse.
Smyrna destroyed by an earthquake.

1689 The land-tax passed in England.
The toleration-act passed in ditto.
Several bishops are deprived for not taking the oaths to William.
William Fuller, who pretended to prove the prince of Wales spurious, was voted by the commons to be a notorious cheat, impostor, and false accuser.

1689 Episcopacy abolished in Scotland.

1690 The battle of the Boyne, gained by William against James, in Ireland.

1691 The war in Ireland finished, by surrender of Limerick to William.
The obliquity of the ecliptic observed by Flamstead to be 23° 28′ 32″.

1692 The English and Dutch fleets, commanded by Admiral Russel, defeat the French fleet off La Hogue.
The massacre of Glencoe in Scotland, Jan. 31. O. S.
Earthquakes in England and Jamaica, September 8.
Hanover made an electorate of the empire.

1693 Bayonets at the end of loaded muskets first used by the French against the confederates in the battle of Turin.
Bank of England established by King William.
The first public lottery was drawn this year.

1694 Queen Mary dies at the age of 33, and William reigns alone.
Stamp duties instituted in England.

1696 The peace of Ryswick.

1699 The Scots settled a colony at the isthmus of Darien in America, and called it *Caledonia*.

1700 Charles XII. of Sweden begins his reign.
King James II. dies at St Germains in the 68th year of his age.

1701 Prussia erected into a kingdom.
Society for the propagation of the gospel in foreign parts established.

1702 King William dies, aged 50, and is succeeded by Queen Anne, daughter to James II. who, with the Emperor and States General, renews the war against France and Spain.
the French sent colonies to the Missisipppi.

1703 The obliquity of the ecliptic observed by Bianchini to be 23° 28′ 25″.

1704 Gibraltar taken from the Spaniards by Admiral Rooke.
The battle of Blenheim won by the Duke of Marlborough and allies against the French.
The court of Exchequer instituted in England.

1706 The treaty of Union betwixt England and Scotland, signed July 22.
The battle of Ramilies won by Marlborough and the allies.

1707 The first British parliament.
The allies defeated at Almanza.

1708 Minorca taken from the Spaniards by General Stanhope.
The battle of Oudenarde won by Marlborough and the allies.

1709 Peter the Great, czar of Moscovy, defeats Charles XII. at Poltowa, who flies to Turkey.
The battle of Malplaquet won by Marlborough and the allies.

1710 Queen Anne changes the whig ministry for others more favourable to the interest of her brother the late Pretender.
The cathedral church of St Paul, London, rebuilt by Sir Christopher Wren in 37 years, at one million expence, by a duty on coals.
The English South-sea company began.

1712 Duke

After Christ.

1712 Duke of Hamilton and Lord Mohun killed in a duel in Hide-Park.
1713 The peace of Utrecht, whereby Newfoundland, Nova Scotia, New Britain, and Hudson's bay, in North America, were yielded to Great Britain; Gibraltar and Minorca, in Europe, were also confirmed to the said crown by this treaty.
1714 Queen Anne dies, at the age of 50, and is succeeded by George I.
Interest in England reduced to five *per cent.*
1715 Louis XIV. dies, and is succeeded by his great-grandson Louis XV. the late king of France.
The rebellion in Scotland begins in September under the Earl of Mar, in favour of the Pretender. The action of Sheriffmuir, and the surrender of Preston, both in November, when the rebels disperse.
The obliquity of the ecliptic observed by Louville to be 23° 28′ 24″.
1716 The Pretender married the princess Sobieska, grand-daughter of John Sobieski, late king of Poland.
An act passed for septennial parliaments.
1718 Sardinia erected into a kingdom, and given to the duke of Savoy.
1719 The Mississippi scheme at its height in France.
Lombe's silk-throwing machine, containing 26,586 wheels, erected at Derby in England: takes up one-eighth of a mile; one water-wheel moves the rest; and in 24 hours it works 318,504,960 yards of organzine silk thread.
1720 The south-sea scheme in England begun April 7, was at its height at the end of June, and quite sunk about September 29.
A great earthquake in China.
1724 An earthquake in Denmark.
1727 King George dies, in the 68th year of his age, and is succeeded by his only son, George II.
Inoculation first tried on criminals with success.
Russia, formerly a dukedom, is now established as an empire.
The abberration of the fixed stars discovered and accounted for by Dr Bradley.
1732 Kouli Khan usurps the Persian throne, conquers the Mogul empire, and returns with two hundred thirty-one millions Sterling.
Several public-spirited gentleman begin the settlement of Georgia in North America.
1733 The Jesuits expelled from Paraguay.
1736 Capt. Porteous having ordered his soldiers to fire upon the populace at an execution of a smuggler, is himself hanged by the mob at Edinburgh.
A transit of Mercury observed by Cassini.
1737 A dreadful hurricane at the mouth of the Ganges, Oct. 10.
1738 Westminister bridge, consisting of 15 arches, begun; finished in 1750, at the expence of 389,000 l. defrayed by parliament.
The order of St Januarius established at Naples.
1739 Letters of marque issued out in Britain against Spain July 21. and war declared, Oct. 23.
The empire of Indostan ruined by Kouli Khan.
An intense frost in Britain.
1743 The battle of Dettingen won by the English and allies in favour of the Queen of Hungary.
1743 A dreadful plague in Sicily.
1744 War declared against France.—Commodore Anson returns from his voyage round the world.
1745 The allies lose the battle at Fontenoy.
The rebellion breaks out in Scotland, and the Pretender's army defeated by the Duke of Cumberland at Culloden, April 16, 1746.
1746 British Linen Company erected.
Lima destroyed by an earthquake.
1747 Kouli Khan murdered.
1748 The peace of Aix-la-Chapelle, by which a restitution of all places taken during the war was to be made on all sides.
1749 The interest on the British funds reduced to 3 *per cent.*
British herring-fishery incorporated.
The colony of Nova Scotia founded.
1750 Earthquake in England.
1751 Frederic prince of Wales, father to his present majesty, died.
Antiquarian society at London incorporated.
1752 The new stile introduced into Great Britain; the 3d of September being counted the 14th.
1753 The British museum erected at Montague-house.
Society of arts, manufactures, and commerce, instituted in London.
1754 A dreadful eruption of mount Ætna.
A great earthquake at Constantinople, Cairo, &c. Sept. 2d.
1755 Quito in Peru destroyed by an earthquake, April 28th.
Lisbon destroyed by an earthquake, Nov. 1st.
1756 146 Englishmen are confined in the black hole at Calcutta in the East Indies by order of the nabob, and 123 found dead next morning.
Marine society established at London.
The King of Prussia commenced hostilities in the month of August in Saxony. Defeats the Austrians at Lo.
1757 Damien attempted to assassinate the French king.
The King of Prussia invades Bohemia. Defeats the Austrians at Reichenberg, April 21st, and at Prague, May 6th. Repulsed by Count Daun at Kolin, June 18th.
The allies defeated by the French at Hastenbeck, July 26th.
Convention of Closter Seven, Sep. 8th.
The king of Prussia defeats the French and Austrians at Rosbach, Nov. 5. The Prussians defeated near Breslaw, Nov. 22d. The Austrians defeated at Lissa, Dec. 5th.
1758 Senegal taken by the British, May 1st. They take Louisbourg, July 27th.
The King of Prussia defeats the Russians at Zorndorf, August 25th. Is defeated by Count Daun at Hoch-kirchen, Oct. 14th.
Goree taken by Commodore Keppel, Dec. 29th.
Attempt to assassinate the King of Portugal, Dec. 3.
1759 General Wolfe is killed in the battle of Quebec, which is gained by the British.
The French defeated by Prince Ferdinand at Bergen, April 13th.
Guadaloupe taken by the British, May 1st.
King of Prussia defeated by the Russians at Cunersdorf, Aug. 12th.

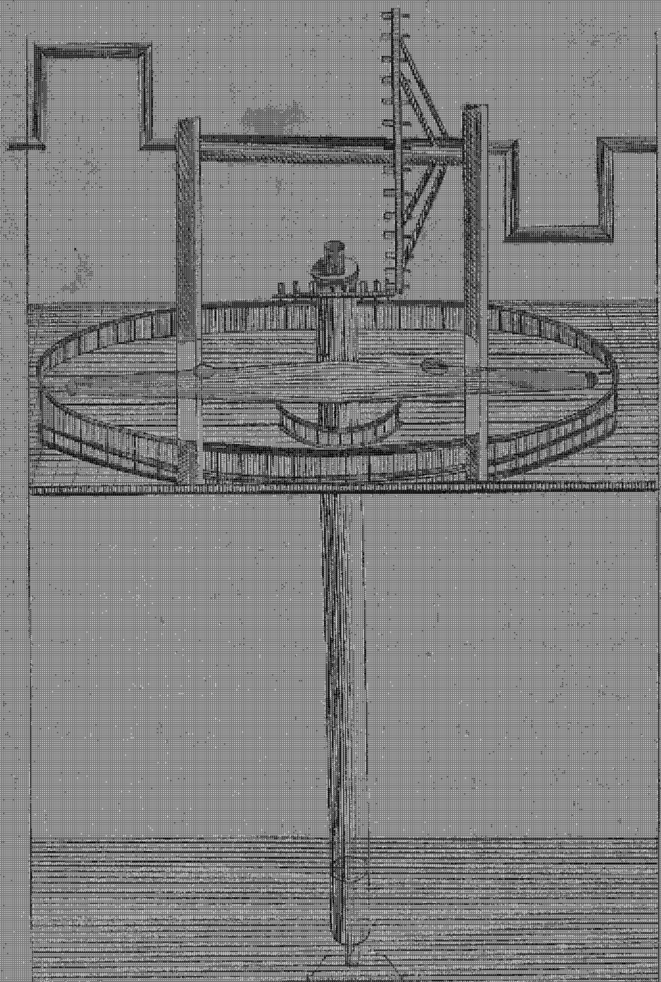
1759 The

After Christ.

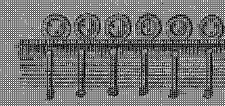
1759 The French fleet defeated by Admiral Hawke, Nov. 20th.
Balbec and Tripoli destroyed by an earthquake, Dec. 5th.
1760 King George II. dies October 25th, in the 77th year of his age, and is succeeded by his present majesty, who, on the 22d of September 1761, married the princess Charlotte of Mecklenburgh Strelitz.
Blackfriars-bridge, consisting of 9 arches, begun; finished 1770, at the expence of 152,840l. to be discharged by a toll.
A transit of Venus over the sun June 6th.
Earthquakes in Syria Oct. 13th.
The King of Prussia defeats the Austrians at Torgau Nov. 3d.
1761 Pondicherry taken by Col. Coote Jan. 15th.
Belleisle surrendered to the British Feb. 4th.
1762 War declared against Spain.
Peter III. emperor of Russia, is deposed, imprisoned, and murdered.
American philosophical society established in Philadelphia.
George Augustus Frederic, prince of Wales, born Aug. 12th
Martinico surrended to the British Feb. 4th.
Havannah surrendered to ditto Aug. 12th.
Manilla taken by ditto Oct. 6th
1763 The definitive treaty of peace between Great Britain, France, Spain, and Portugal, concluded at Paris February 10th; which confirms to Great Britain the extensive provinces of Canada, East and West Florida, and part of Louisiana, in North America: also the islands of Granada, St Vincent, Dominica, and Tobago, in the West Indies.
The Jesuits expelled from France.
1764 The parliament granted 10,000 l. to Mr Harrison for his discovery of the longitude by his time-piece.
Famine and pestilence in Italy.
An earthquuke at Lisbon.
1765 His majesty's royal charter passed for incorporating the society of artists.
An act passed annexing the sovereignty of the island of Man to the crown of Great Britain.
1766 April 21st. a spot or macula of the sun, more than thrice the bigness of our earth, passed the sun's centre.
The American stamp-act repealed March 18th
A great earthquake at Constantinople.
The Jesuits expelled from Bohemia and Denmark.
1767 The Jesuits expelled from Spain, Venice, and Genoa, April 2d.
Martinico almost destroyed by an earthquake.
The protestants tolerated in Poland Nov. 2d.
1768 Academy of painting established in London.
The Turks imprison the Russian ambassador, and declare war against that empire.
The Jesuits expelled from Naples, Malta, and Parma.
1769 Paoli fled from Corsica June 13th. The island then reduced by the French.
1770 An earthquake at St Domingo.
1771 Dr Solander and Mr Banks, in his Britannic majesty's ship the Endeavour, Lieut. Cook, return from a voyage round the world, having made several important discoveries in the Southseas.
An emigration of 500,000 Tourgouths from the coasts of the Caspian Sea to the frontiers of China.
1772 The King of Sweden changes the constitution from aristocracy to a limited monarchy.
The pretender marries a princess of Germany, grand-daughter of Thomas late Earl of Aylesbury.
The emperor of Germany, Empress of Russia, and the King of Prussia, strip the King of poland of a great part of his dominions, which they divide among themselves, in violation of the most solemn treaties.
1773 Captain Phipps is sent to explore the North Pole; but having made 81 degrees, is in danger of being locked up by the ice, and his attempt to discover a passage in that quarter proves fruitless.
The English East India company having, by conquest or treaty, acquired the extensive provinces of Bengal, Orixa, and Bahar, containing 15 millions of inhabitants, great irregularities are committed by their servants abroad; upon which government interferes, and sends out judges &c. for the better administration of justice.
The war between the Russians and the Turks proves disgraceful to the latter, who lose the Islands in the Archipelago, and by the sea are every where unsuccessful.
The society of Jesuits suppressed by the Pope's bull August 25th.
1774 Peace is proclaimed between the Russians and the Turks.
The British parliament having passed an act laying a duty of 3d. *per* pound upon all teas imported into America, the colonists, considering this as a greivance, deny the right of the British parliament to tax them.
The American colonies send deputies to Philadelphia, who assume the title of *The Congress of the Thirteen United Provinces.*
1775 The the American war commences. Action at Bunker's Hill June 7th.
The Spaniards land near Algiers and are defeated July 8th.
1776 The congress declare the United States of America independent of the crown and parliament of Great Britain, 4th July.
The Americans receive a dreadful defeat at Long-Island August 27th.
1777 Philadelphia taken by the British Oct. 3d.
General Burgoyne with his army surrender to the Americans.
1778 Philadelphia evacuated by the British, June 18th.
1779 A most extraordinary eruption of Vesuvius August 8th.
The siege of Gibraltar begun by the Spaniards July 8th.

1780

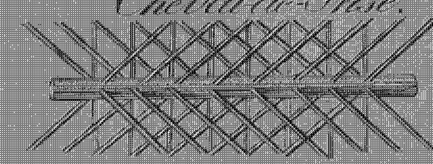
Centrifugal Machine



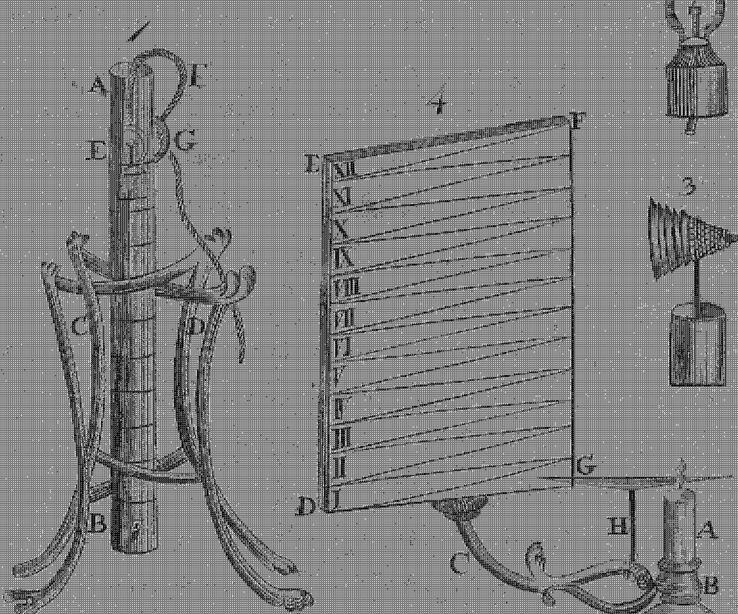
Chain-wales.



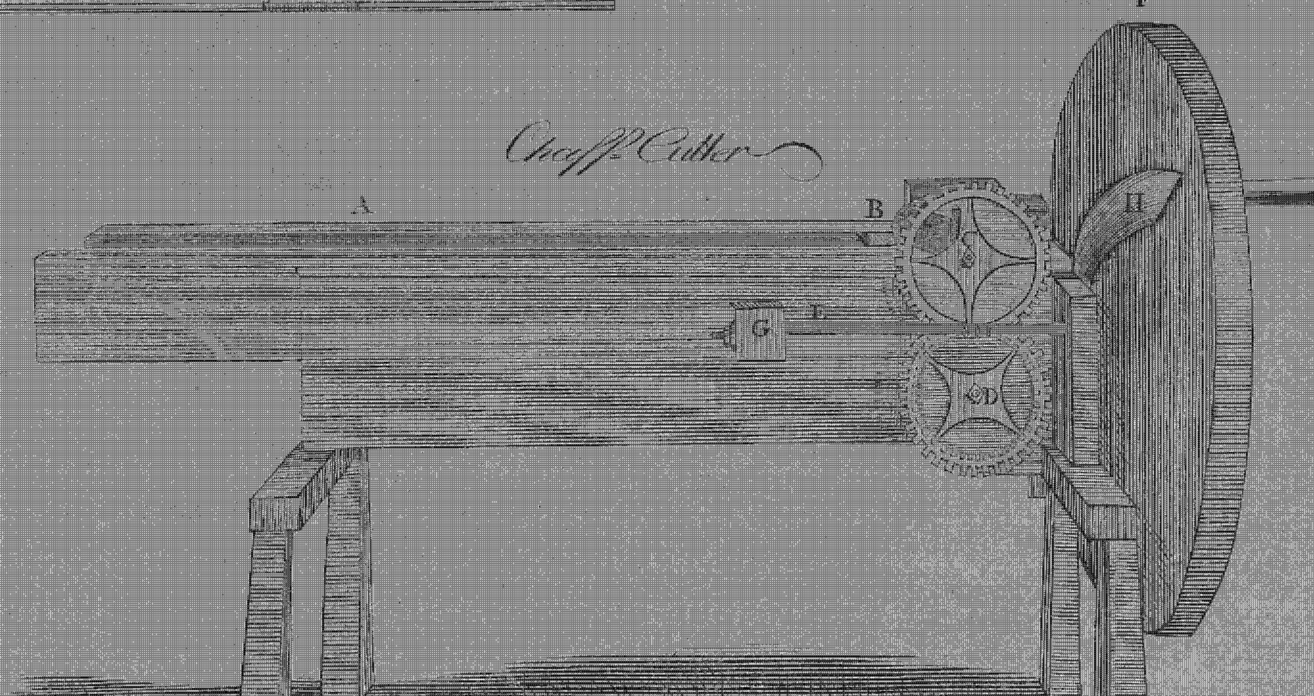
Cheval-de-Frise.



Chronometer




Chaff Cutter



## CHIMES.

Fig. 1.
The Notes of the 100 Psalm tune

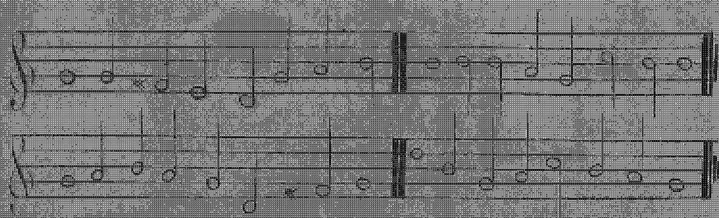
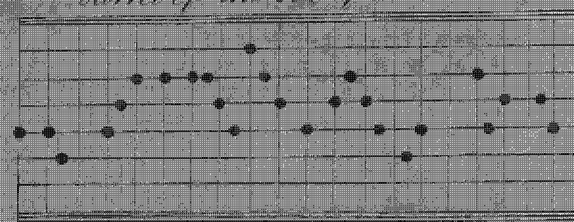


Fig. 2.
A Table for dividing the Chime barrel of the 100 Psalm tune



## CIPHER.

Fig. 3.

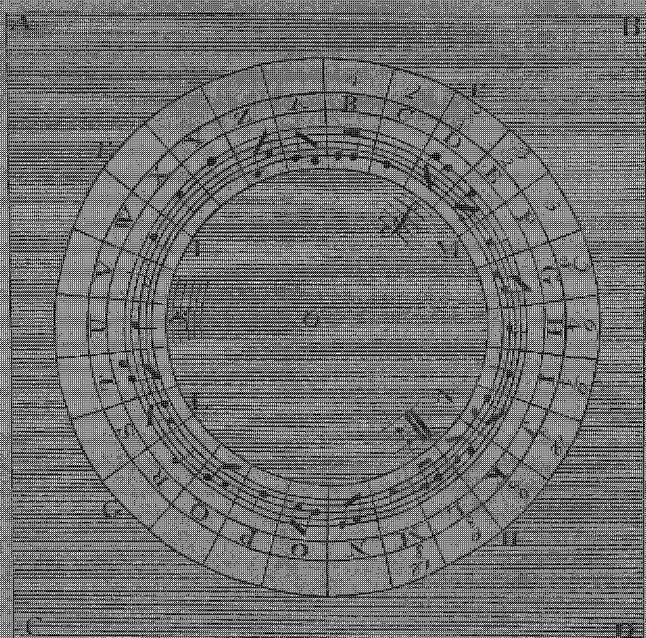


Fig. 4.

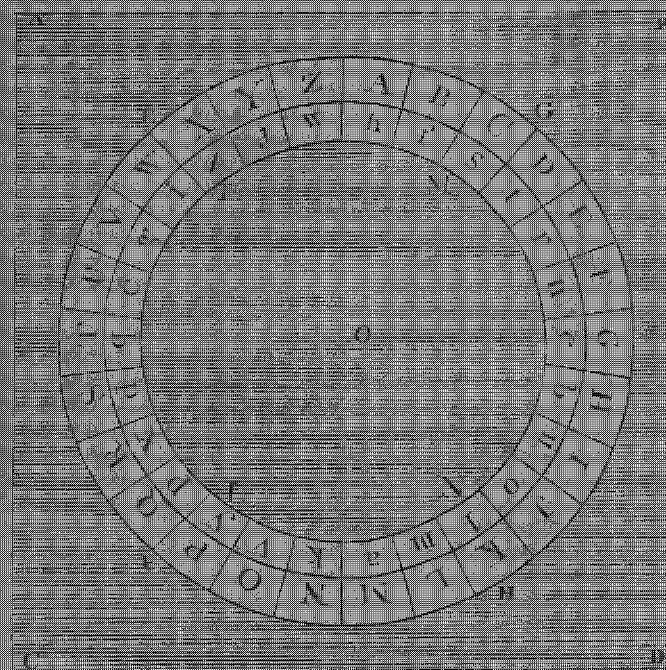


Fig. 5.


Fig. 6.

*Ma un jvc ummm svar*
*eqrx qi cd jvc dbhmm*
*bhgr h yrkduvk hkt-*
*jvc ahj dqumm ahlr*
*h dbha vyyrduquvh*

Fig. 7.

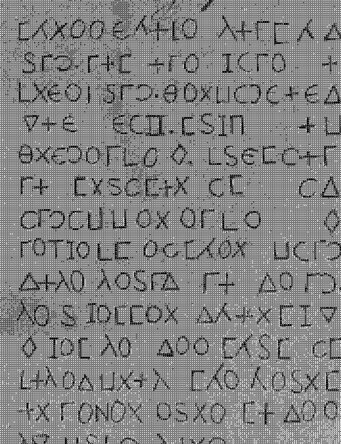


Fig. 8.

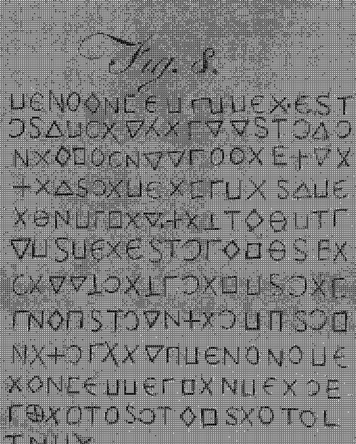
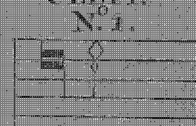


Fig. 9.
CLEFF.

Nº 1.



Nº 2.

Nº 3.

1780 Jan. 14th, 6 h. A. M. the thermometer ſuſpended in the open air at Glaſgow, ſtood at 46° below 0.
The Spaniſh fleet defeated by Admiral Rodney Jan. 16th.
Charleſton ſurrendered to the Britiſh May 12th.
A dreadful inſurrection in London, and riots in many other places of the kingdom.
A great number of Britiſh ſhips taken by the combined fleets of France and Spain.
Lord Cornwallis defeats the Americans at Camden.
A dreadful hurricane in the Leeward Iſlands, Oct. 9th.
An extraordinary ſtorm of wind in England.
War declared againſt the Dutch Dec. 20th.

1781 A terrible engagement between the Dutch and Britiſh fleets near the Dogger Bank Aug. 5.
Lord Cornwallis with his army ſurrender to the united forces of France and America Oct. 18th.

1782 Minorca ſurrendered to the Spaniards February 4th.
The French fleet under De Graſſe defeated and almoſt deſtroyed by Admiral Rodney April 12th.
The Spaniſh floating batteries before Gibraltar entirely deſtroyed Sept. 12th.

1783 Preliminaries of a general peace ſigned. America declared independent Jan. 20th.
A dreadful earthquake, attended with many extraordinary circumſtances, in Italy and Sicily.
The ſun obſcured by a kind of fog during the whole ſummer.
A volcanic eruption in Iceland ſurpaſſing any thing recorded in hiſtory. The lava ſpouted up in three places to the height of two miles perpendicular, and continued thus for two months; during which time it covered a tract of 3600 ſquare miles of ground, in ſome places more than 100 feet deep.
A large meteor appears to the northward of Shetland, and takes its direction ſouthward, with a velocity little inferior to that of the earth in its annual courſe round the ſun. Its tract obſerved for more than 1000 miles.

1787 General Convention meet at Philadelphia for the purpoſe of forming a new conſtitution, which was afterwards adopted by all the ſtates.

1789 Firſt Congreſs meet under the federal conſtitution March 4th.
States General opened at Paris April 25th.
Baſtile demoliſhed by the people July 14th.
Conſtitution of France framed Auguſt 6th.

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Chronometer.

CHRONOMETER, in general, denotes any inſtrument or machine uſed in meaſuring time; ſuch are dials, clocks, watches, *&c.* See DIAL, *&c.*

The term *chronometer*, however, is generally uſed in a more limited ſenſe, for a kind of clock ſo contrived as to meaſure a ſmall portion of time with great exactneſs, even to the ſixteenth part of a ſecond: of ſuch a one there is a deſcription in Deſagulier's experimental philoſophy, invented by the late ingenious Mr George Graham; which muſt be allowed to be of great uſe for meaſuring ſmall portions of time in aſtronomical obſervations, the time of the fall of bodies, the velocity of running waters, *&c.* But long ſpaces of time cannot be meaſured by it with ſufficient exactneſs, unleſs its pendulum be made to vibrate in a cycloid; becauſe, otherwiſe it is liable to err conſiderably, as all clocks are which have ſhort pendulums that ſwing in large arches of a circle.

There have been ſeveral machines contrived for meaſuring time, under the name of *chronometers*, upon principles very different from thoſe on which clocks and watches are conſtructed.

Plate CXXXVI. fig. 1. repreſents an air-chronometer, which is conſtructed in the following manner. Provide a glaſs tube of about an inch in diameter, and three or four feet long: the diameter of the inſide of this tube muſt be preciſely equal in every part: at the bottom muſt be a ſmall hole, cloſely covered with a valve. In the tube place a piſton E, fig. 2. which is made to fit it exactly, and muſt be oiled, that it may move in the tube with the greateſt freedom: in this piſton there is a cock that ſhuts quite cloſe; and from the top of it there goes a cord F, which paſſes through the handle G. The cock of the piſton being cloſed, it is to be let down to the bottom of the tube, and being then drawn up to the top, the air will then ruſh in by the valve at the bottom of the tube, and ſupport the piſton. You are then to turn the cock, ſo as to make a very ſmall vent; and the air paſſing ſlowly through that vent, the piſton will gradually deſcend, and ſhow the hour, either by lines cut in the tube with a diamond, or marked with paint, or by ſmall ſlips of paper painted on the glaſs. If this chronometer ſhould go too faſt or two ſlow, it may be eaſily regulated by altering the poſition of the cock in the piſton, as it is on that the whole depends.

If, inſtead of marking the tube, you would have the time ſhown by a dial, it may be eaſily effected by placing an axis to which the hand of the dial is fixed, directly over the tube, and winding the ſtring to which the piſton is joined round that axis; for then, as the piſton deſcends, the axis will gradually turn the hand, and ſhow the hour: but it muſt be obſerved, that as the deſcent of the piſton is not conſtantly regular, on account of the decreaſe of reſiſtence from the quantity of the ſubjacent air as the piſton deſcends, the axis therefore muſt not be a regular cylinder, but conical like the fuſee of a watch, as in fig. 3. by which means the motion of the hand of the dial will be conſtant and regular.

Fig. 4. repreſents a lamp-chronometer. It conſiſts of a chamber lamp A, which is a cylindrical veſſel about three inches high, and one inch diameter, placed in the ſtand B. The inſide of this veſſel muſt be every where exactly of the ſame diameter. To the ſtand B is fixed the handle C, which ſupports the frame DEFG, about 12 inches high, and four wide. This frame is to be covered with oiled paper, and divided into twelve equal parts by horizontal lines; at the end of which are wrote the numbers for the hours, from 1 to 12, and between the horizontal lines are diagonals that are divided into halves, quarters, *&c.* On the handle B, and cloſe to the glaſs, is fixed the ſtyle or gnomon H. Now, as the diſtance of the ſtyle from the flame of the lamp is only half an inch, if the diſtance of the frame from the ſtyle is only ſix inches, then, while the float that contains the light deſcends,

descends, by the decrease of the oil, one inch, the shadow of the style on the frame will ascend twelve inches, that is, its whole length, and show by its progression the regular increase of the hours, with their several divisions. It is absolutely necessary, however, that the oil used in this lamp be always of the same sort and quite pure, and that the wick also be constantly of the same size and substance, as it is on these circumstances, and the uniform figure of the vessel, that the regular, progress of the shadow depends.

CHRONOMETER, among musicians, an instrument invented by *Loulie*, a French musician, for the purpose of measuring time by means of a pendulum. The form of the instrument, as described by him, is that of an Ionic pilaster, and is thus described by Malcolm in his Treatise of Music, p. 407.—" The chronometer consists of a large ruler or board, six feet or 72 inches long, to be set on end; it is divided into its inches, and the numbers set so as to count upwards; and at every division there is a small round hole, through whose centre the line of division runs. At the top of this ruler, about an inch above the division 72, and perpendicular to the ruler, is inserted a small piece of wood, in the upper side of which there is a groove, hollowed along from the end that stands out to that which is fixed in the ruler, and near each end of it a hole is made: through these holes a pendulum cord is drawn, which runs in the groove: at that end of the cord which comes through the hole furthest from the ruler, the ball is hung; and at the other end there is a small wooden pin, which can be put in any of the holes of the ruler: when the pin is in the upmost hole at 72, then the pendulum from the top to the centre of the ball must be exactly 72 inches; and therefore, whatever hole of the ruler it is put in, the pendulum will be just so many inches as that figure at the hole denotes. The manner of using the machine is this: The composer lengthens or shortens his pendulum, till one vibration be equal to the designed length of his bar, and then the pin stands at a certain division, which marks the length of the pendulum; and this number being set with the cliff at the beginning of the song, is a direction for others how to use the chronometer, in measuring the time according to the composer's design: for with the number is set the note, crotchet, or minim, whose value he would have the vibration to be; which in brisk duple time is best a minim or half bar, or even a whole bar, when that is but a minim; and in slow time a crotchet. In triple time, it would do well to be the third part or half, or fourth part of a bar; and in the simple triples that are allegro, let it be a whole bar. And if, in every time that is allegro, the vibration is applied to a whole or half bar, practice will teach us to subdivide it justly and equally. Observe, that, to make this machine of universal use, some canonical measure of the divisions must be agreed upon, that the figure may give a certain direction for the length of the pendulum.

CHROSTASIMA, in natural history, a genus of pellucid gems, comprehending all those which appear of one simple and permanent colour in all lights; such are the diamond, carbuncle, ruby, garnet, amethyst, sapphire, beryl, emerald, and the topaz. See DIAMOND, CARBUNCLE, *&c.*

CHRYSA, (anc. geog.), a town of Mysia, on the sinus Adramyttenus; extinct in Pliny's time: it had a temple of Apollo Smintheus (Homer, Strabo). The country of the fair Chryseis, who gave first rise to the quarrel between Agamemnon and Achilles.

CHRYSALIS, or AURELIA, in natural history, a state of rest and seeming insensibility, which butterflies, moths, and several other kinds of insects, must pass through before they arrive at their winged or most perfect state.

In this state, no creatures afford so beautiful a variety as the butterfly kinds, and they all pass through this middle state without one exception. The figure of the aurelia or chrysalis generally approaches to that of a cone, or at least the hinder part of it is in this shape; and the creature, while in this state, seems to have neither legs nor wings, nor has any power of walking. It seems indeed to have hardly so much as life. It takes no nourishment in this state, nor has it any organs for taking any; and indeed its posterior part is all that seems animated, this having a power of giving itself some motions. The external covering of the chrysalis is cartilaginous, and considerably large, and is usually smooth and glossy: but some few of them have a few hairs; some are also as hairy as the caterpillars from which they are produced; and others are rough, and, as it were, shagreened all over.

In all of these there may be distinguished two sides; the one of which is the back, the other the belly of the animal. On the anterior part of the latter, there may always be distinguished certain little elevations running in ridges, and resembling the fillets wound about mummies: the part whence these have their origin, is esteemed the head of the animal. The other side, or back, is smooth, and of a rounded figure in most of the chrysalises; but some have ridges on the anterior part, and sides of this part; and these usually terminate in a point, and make an angular appearance on the chrysalis.

From this difference is drawn the first general distinction of these bodies. They are by this divided into two classes; the round and the angular kinds. The first are, by the French naturalists, called *feves*; from the common custom of calling the chrysalis of the silkworm, which is round, by this name.

There is something more regular in this distinction than might at first be conceived; for the division is continued from the fly-state: the rounded chrysalises being almost all produced by the *phalenæ*, or moths; and the angular ones by the *papilios*, or day-flies. There are several subordinate distinctions of these kinds; but, in general, they are less different from one another than the caterpillars from whence they are produced.

The head of those of the first class usually terminates itself by two angular parts, which stand separate one from the other, and resemble a pair of horns. On the back, eminences and marks are discovered, which imagination may form into eyes, nose, chin, and other parts of the human face.

There is a great variety and a great deal of beauty in the figures and arrangement of the eminences and spots on the other part of the body of the chrysalises of different kinds. It is a general observation, that those chrysalises which are terminated by a single horn, afford day-butterflies of the kind of those which have buttoned

Chryfalis. buttoned antennæ, and whofe wings, in a ftate of reft, cover the under part of their body, and which ufe all their fix legs in walking, thofe of many other kinds ufing only four of them. Thofe chryfalifes which are terminated by two angular bodies, and which are covered with a great number of fpines, and have the figure of a human face on their back in the greateft perfection, afford butterflies of the day-kind; and of that clafs the characters of which are, their walking on four legs, and ufing the other two, that is, the anterior part, in the manner of arms or hands. The chryfalifes which have two angular bodies on their heads, but fhorter than thofe of the preceding, and whofe back fhows but a faint fketch of the human face, and which have fewer fpines, and thofe lefs fharp, always turn to that fort of butterfly the upper wings of which are divided into fegments, one of which is fo long as to reprefent a tail, and whofe under wings are folded over the upper part of the back. A careful obfervation will eftablifh many more rules of this kind, which are not fo perfect as to be free from all exceptions; yet are of great ufe, as they teach us in general what fort of fly we are to expect from the chryfalis, of which we know not the caterpillar, and therefore can only judge from appearances.

Thefe are the principal differences of the angular chryfalifes; the round ones alfo have their different marks not lefs regular than thofe.

The greater number of the round chryfalifes have the hinder part of their body of the figure of a cone; but the upper end, which ought to be its circular plane bafe, is ufually bent and rounded into a fort of knee: this is ufually called the head of the chryfalis; but there are alfo fome of this kind, the head of which is terminated by a nearly plane furface: fome of the creeping ten-legged caterpillars give chryfalifes of this kind, which have each of them two eminences that feem to bring them towards the angular kind.

Among the angular chryfalifes there are fome whofe colours feem as worthy our obfervation as the fhapes of the others. Many of them appear fuperbly clothed in gold. Thefe elegant fpecies have obtained the name of *chryfalis* and *aurelia*, which are derived from Greek and Latin words, fignifying gold; and from thefe all other bodies of the fame kind have been called by the fame names, though lefs, or not at all, intitled to them. As fome kinds are thus gilded all over, fo others are ornamented with this gay appearance in a fparing manner, having only a few fpots of it in different places on their back and belly. Thefe obvious marks, however, are not to be depended upon as certain characters of diftinction: for accidents in the formation of the chryfalis may alter them; and thofe which naturally would have been gilded all over, may be fometimes only fo in part; and either thefe or the others may, by accident, be fo formed, as to fhow nothing of this kind at all, but be only of a dufky brown. Thofe, however, which have neither filver nor gold to recommend them to your eyes, do not want other colours, and thofe beautifully variegated. Some of them are all over of an elegant green, as is the chryfalis of the fennel-caterpillar; others of an elegant yellow; and fome of a bright greenifh tinge, variegated with fpots of a fhining black: we have a very beautiful inftance of this laft kind in the chryfalis of the elegant cabbage-caterpillar. The general colour of the chryfalis of the common butterflies, however, is brown. Chryfalis.

Some are alfo of a fine deep black; and of thefe many are fo fmooth and gloffy, that they are equal to the fineft Indian japan. The common caterpillar of the fig-tree gives an inftance of one of thefe moft beautiful gloffy ones; the caterpillar of the vine affords another of thefe fine black chryfalifes.

The rounded chryfalifes do not afford any thing of that variety of colouring fo remarkably beautiful in the angular ones; they are ufually of a dufky yellow, in different fhades, and are often varioufly fpotted with black: but thefe, as well as all other chryfalifes, before they arrive at their fixed colour, pafs through feveral other temporary ones; fome being of a different colour when firft produced from the caterpillar, from what they are a few days afterwards; and fome varying fo greatly, though only in degree, as not to be diftinguifhable, even by the moft converfant eye, from what they were when firft produced. The green rough caterpillar of the cabbage has a chryfalis which is green at firft; and from that gradually goes through all the fhades of green to faint yellow, which is its lafting colour; and one of the oak caterpillars yields a chryfalis beautifully fpotted with red at its firft appearance; but thefe fpots change to brown for their fixed colour: the third day from their formation ufually fixes their lafting colours; and if they are obferved to turn black in any part after this time, it is a fign that they are dead or dying.

The feveral fpecies of infects, as a fly, fpider, and an ant, do not differ more evidently from one another in regard to appearance, than do a caterpillar, its chryfalis, and a butterfly produced from it; yet it is certain, that thefe are all the product of the fame individual egg; and nothing is more certain, than that the creature which was for a while a caterpillar, is, after a certain time, a chryfalis, and then a butterfly. Thefe great changes produced in fo fudden a manner, feem like the *metamorphofes* recorded in the fables of the ancients; and indeed it is not improbable that thofe fables firft took their origin from fuch changes.

The parts being diftinguifhable in the chryfalis, we eafily find the difference of the fpecies of the fly that is to proceed from it. The naked eye fhows whether it be one of thofe that have, or of thofe that have not, a trunk; and the affiftance of a microfcope fhows the antennæ fo diftinctly, that we are able to difcern whether it belongs to the day or night clafs; and often to what genus, if not the very fpecies: nay, in the plumofe horned kinds, we may fee, by the antennæ, whether a male or female phalæna is to be produced from the chryfalis; the horns of the female being in this ftate evidently narrower, and appearing lefs elevated above the common furface of the body, than thofe of the male.

All thefe parts of the chryfalis, however, though feen very diftinctly, are laid clofe to one another, and feem to form only one mafs; each of them is covered with its own peculiar membrane in this ftate, and all are furrounded together by a common one; and it is only through thefe that we fee them; or rather we fee on thefe the figures of all the parts moulded within;

Chryfalis. and therefore it requires attention to diftinguifh them. The chryfalis is foft when firft produced, and is wetted on the front with a vifcous liquor; its fkin, though very tender at firft, dries and hardens by degrees: but this vifcous liquor, which furrounds the wings, legs, *&c.* hardens almoft immediately; and in confequence faftens all thofe limbs, *&c.* into a mafs, which were before loofe from one another: this liquor, as it hardens, lofes its tranfparence, and becomes brown; fo that it is only while it is yet moift that thefe parts are to be feen diftinct.

It is evident from the whole, that the chryfalis is no other than a butterfly, the parts of which are hid under certain membranes which faften them together; and, when the limbs are arrived at their due ftrength, they become able to break through thefe membranes, and then expand and arrange themfelves in their proper order.

The firft metamorphofis, therefore, differs nothing from the fecond, except that the butterfly comes from the body of the caterpillar in a weak ftate, with limbs unable to perform their offices, whereas it comes from the chryfalis perfect.

*Hiftory of Infects,* vol. i. p. 2.—28. M. Reaumur has given us many curious obfervations on the ftructure and ufes of the feveral coverings that attend the varieties of the caterpillar-kind in this ftate.

The creatures in general remain wholly immoveable in this ftate, and feem to have no bufinefs in it but a patient attendance on the time when they are to become butterflies; and this is a change that can happen to them only as their parts, before extremely foft and weak, are capable of hardening and becoming firm by degrees, by the tranfpiration of that abundant humidity which before kept them foft: and this is proved by an experiment of M. Reaumur, who, inclofing fome chryfalifes in a glafs tube, found, after fome time, a fmall quantity of water at the bottom of it; which could have come there no other way, but from the body of the inclofed animal. This tranfpiration depends greatly on the temperature of the air; it is increafed by heat, and diminifhed by cold; but it has alfo its peculiarities in regard to the feveral fpecies of butterfly to which the chryfalis belongs.

According to thefe obfervations, the time of the duration of the animal in the chryfalis ftate muft be, in different fpecies, very different; and there is indeed this wide difference in the extremes, that fome fpecies remain only eight days in this ftate, and others eight months.

We know that the caterpillar changes its fkin four or five times during its living in that ftate; and that all thefe fkins are at firft produced with it from the egg, lying clofely over one another. It parts with, or throws off all thefe one by one, as the butterfly, which is the real animal, all this time within, grows more and more perfect in the feveral firft changes. When it throws off one, it appears in another fkin exactly of the fame form; but at its final change from this appearance, that is, when it throws off the laft fkin, as the creature within is now arrived at fuch a degree of perfection as to need no farther taking of nourifhment, there is no farther need of teeth, or any of the other parts of a caterpillar. The creature, in this laft change, proceeds in the very fame manner as in all the former, the fkin opening at the back, and the animal making its way out in this fhape. If a caterpillar, when about to throw off this laft fkin, be thrown into fpirits of wine, and left there for a few days, the membranes within will harden, and the creature may be afterwards carefully opened, and the chryfalis taken out, in which the form of the tender butterfly may be traced in all its lineaments, and its eyes, legs, *&c.* evidently feen. It is not neceffary, however, to feize upon this exact time for proving the exiftence of the chryfalis or butterfly in the caterpillar: for if one of thefe animals be thrown into fpirit of wine, or into vinegar, fome days before that time, and left there for the flefh to harden, it may afterwards be diffected, and all the lineaments of the butterfly traced out in it, the wings, legs, antennæ, *&c.* being as evident here, and as large, as in the chryfalis.

It is very plain from this, that the change of the caterpillar into chryfalis, is not the work of a moment; but is carrying on for a long time before, even from the very hatching of the creature from the egg. The parts of the butterfly, however, are not difpofed exactly in the fame manner while in the body of the caterpillar, as when left naked in the form of the chryfalis: for the wings are proportionally longer and narrower, being wound up into the form of a cord; and the antennæ are rolled up on the head; the trunk is alfo twifted up and laid upon the head; but this in a very different manner from what it is in the perfect animal, and very different from that in which it lies within the chryfalis; fo that the firft formation of the butterfly in the caterpillar, by time arrives at a proper change of the difpofition of its parts, in order to its being a chryfalis. The very eggs, hereafter to be depofited by the butterfly, are alfo to be found not only in the chryfalis, but in the caterpillar itfelf, arranged in their natural, regular order. They are indeed in this ftate very fmall and tranfparent; but after the change into the chryfalis, they have their proper colour.

As foon as the feveral parts of the butterfly, therefore, are arrived at a ftate proper for being expofed to the more open air, they are thrown out from the body of the caterpillar, furrounded only with their membranes; and as foon as they are arrived after this at a proper degree of ftrength and folidity, they labour to break through thefe thinner coverings, and to appear in their proper and natural form. The time of their duration in this ftate of chryfalis is very uncertain, fome remaining in it only a few days, others feveral months, and fome almoft a year in appearance. But there is a fallacy in this that many are not aware of. It is natural to think, that as foon as the creature has inclofed itfelf in its fhell, be that of what matter it will, it undergoes its change into the chryfalis ftate. And this is the cafe with the generality: yet there are fome which are eight or nine months in the fhell before they become chryfalifes; fo that their duration in the real chryfalis ftate is much fhorter than it naturally appears to be. M. Reaumur carefully watched the auriculated caterpillar of the oak in its feveral changes, and particularly from its chryfalis, which is of this laft kind, into the fly; and has given an account of the method of this as an inftance

ftance of the general courfe of nature in thefe operations.

The membranes which envelope the creature in this chryfalis ftate are at firft tough and firm, and immediately touch the feveral parts of the inclofed animal; but by degrees, as thefe parts harden, they become covered, fome with hairs, and others with fcales. Thefe, as they continue to grow, by degrees fall off the feveral particular membranes which cover the parts on which they are placed, to a greater diftance, and by degrees loofen them from the limbs. This is one reafon of thofe membranes drying and becoming brittle.

The middle of the upper part of the CORSELET is ufually marked with a line which runs in a longitudinal direction: and this part is always more elevated than the reft, even in the conic kinds, which are no otherwife angular. This line is in fome very bold and plain; in others it is fo faint as not to be diftinguifhable without glaffes; but it is always in the midft of that line that the fhell begins to open. The motion of the head of the butterfly backwards firft occafions this crack; and a few repetitions of the fame motion open it the whole length of the line.

The clearing itfelf, however, entirely, is a work of more time in this cafe, than is the paffing of the chryfalis out of the body of the caterpillar. In that cafe there is a crack fufficiently large in the fkin of the back, and the whole chryfalis being loofe comes out at once. But in this cafe, every particular limb, and part of the body, has its feparate cafe; and thefe are almoft inconceivably thin and tender, yet it is neceffary that every part be drawn out of them before it appear naked to the open air. As foon as all this is effected, and the animal is at full liberty, it either continues fome time upon the remains of its covering, or creeps a little way diftant from it, and there refts. The wings are what we principally admire in this creature. Thefe are at this time fo extremely folded up, and placed in fo narrow a compafs, that the creature feems to have none at all: but they by degrees expand and unfold themfelves; and finally, in a quarter of an hour, or half an hour at the utmoft, they appear at their full fize, and in all their beauty. The manner of this fudden unfolding of the wings is this: the fmall figure they make when the creature firft comes out of its membranes, does not prevent the obferving that they are at that time confiderably thick. This is owing to its being a large wing folded up in the niceft manner, and with folds fo arranged as to be by no means fenfible to the eye, for the wing is never feen to unfold; but, when obferved in the moft accurate manner feems to grow under the eye to this extent. When the creature is firft produced from the fhell, it is every where moift and tender; even its wings have no ftrength or ftiffnefs till they expand themfelves; but they then dry by degrees, and, with the other parts, become rigid and firm. But if any accident prevents the wings from expanding at their proper time, that is, as foon as the creature is out of its fhell, they never afterwards are able to expand themfelves; but the creature continues to wear them in their contracted and wholly ufelefs ftate; and very often, when the wings are in part extended before fuch an accident happens, it ftops them in a partial extenfion, and the creature muft be contented to pafs its whole life with them in that manner.



M. Reaumur has proved, that heat and cold make great differences in the time of hatching the butterfly from its chryfalis ftate: and this he particularly tried with great accuracy and attention, by putting them in veffels in warm rooms, and in ice-houfes; and it feemed wholly owing to the haftening or retarding the evaporation of the abundant humidity of the animal in the chryfalis ftate, that it fooner or later appeared in the butter-fly form. He varnifhed over fome chryfalifes, in order to try what would be the effect of thus wholly preventing their tranfpiration; and the confequence was, that the butterfly came forth from thefe two months later than their natural time. Thus was the duration of the animal in this ftate lengthened; that is, its exiftence was lengthened: but without any advantage to the creature, fince it was in the time of its ftate of inaction, and probably of infenfibility.

Though this was of no confequence, M. Reaumur deduces a hint from it that feems to be of fome ufe. He obferves, that hens eggs, of which we make fo many ufes, and eat in fo many forms, are properly a fort of chryfalis of the animal; their germ, after they are impregnated by the cock, containing the young animal alive, and waiting only a due degree of warmth to be hatched, and appear in its proper form. Eggs tranfpire notwithftanding the hardnefs of their fhells; and when they have been long kept, there is a road found near one of their ends, between the fhell and the internal membrane; this is a mark of their being ftale, and is the effect of an evaporation of part of their humidity: and the fame varnifh which had been ufed to the chryfalis, being tried on eggs, was found to preferve them for two years, as frefh as if laid but the fame day, and fuch as the niceft palate could not diftinguifh from thofe that were fo. See EGGS.

It is not yet known how much farther this ufeful fpeculation might be carried, and whether it might not be of great ufe even to human life, to invent fomething that fhould act in the manner of this varnifh, by being rubbed over the body, as the *athletæ* did of old, and the favages of the Weft Indies do at this time, without knowing why. But to return to the infects which are the fubjects of this article; their third ftate, that in which they are winged, is always very fhort, and feems deftined for no other action but the propagation of the fpecies. See PAPILIO.

CHRYSANTHEMUM, CORN-MARIGOLD: A genus of the polygamia fuperflua order, belonging to the fyngenefia clafs of plants; and in the natural method ranking under the 49th order, *Compofitæ*. The receptacle is naked; the pappus marginated, or confifting only of a border: the calyx hemifpherical and imbricated, with the marginal fcales membranaceous. There are 19 fpecies, of which the following are the moft remarkable: 1. The ferotinum is a native of North America. The roots of this plant creep far under the furface, and fend up ftrong ftalks more than four feet high, garnifhed with long fawed leaves ending in points. Thefe ftalks divide upward into many fmaller; each being terminated by a large white, radiated flower, which appears in the end of Auguft or September. 2. The coronarium hath been long cultivated in the gardens on account of the beauty of its

 flowers.

flowers. It grows to the height of three feet, with a single upright stalk divided into numerous branches, garnished with pinnated leaves, and crowned with elegant compound flowers of different colours and properties. The varieties are, single and double flowers of a cream-colour; yellow; yellow and white: brimstone-coloured; fistular, or quilled; or those with finely jagged leaves, and flowers of all the above colours and properties. All the varieties begin flowering in July: the flowers are exceedingly numerous, and exhibit a constant succession of full bloom till November; and both single and double are succeeded by abundance of seed. 3. The putescens is a native of the Canary islands. It rises with a shrubby stalk near two feet high, dividing into many branches, which are garnished with pretty thick succulent leaves, of a greyish colour, cut into many segments. The flowers come out from the wings of the leaves, growing upon naked footstalks singly, which greatly resemble those of chamomile. There is a succession of flowers on the same plant for the greatest part of the year, for which it is chiefly esteemed. This plant will perfect seeds in Britain when the seasons are favourable.

*Culture.* The first kind multiplies very fast by its creeping roots, and will thrive in any soil or situation. The second may be raised in abundance from seed, either in a hot-bed or warm border, in the spring, for transplanting; also by cuttings and slips of their branches in autumn. The latter method is practised only for the propagation of the fine doubles, for an early bloom the following summer; and the best time to perform it is in September, or early in October. Cut off at that time a quantity of the robust side shoots, from three to six inches long, without flowers; divest them of the lower leaves, and plant many of them together in large pots, within an inch or two of their tops, and two or three inches apart, give some water, and place them in the shade during the hot weather: by the end of October they will be rooted, when the pots are to be removed either into a greenhouse or garden-frame, for the winter; but the latter is the most eligible, where they may enjoy the full air in mild weather, and have occasional shelter from frost. In April they may be transplanted singly into borders and some in pots. The plants thus raised will flower a month or six weeks sooner the succeeding summer than those raised in the spring from seed; but as they soon become barren, it is proper to have always a quantity of plants raised from the seed. The third sort may be raised either from seeds or cuttings, but requires to be sheltered in the green-house in winter.

CHRYSES, the priest of Apollo, father of Astynome, called from him *Chryseis.* When Lyrnessus was taken, and the spoils divided among the conquerors, Chryseis fell to the share of Agamemnon. Chryses upon this went to the Grecian camp to solicit his daughter's restoration; and when his prayers were fruitless, he implored the aid of Apollo, who visited the Greeks with a plague, and obliged them to restore Chryseis.

CHRYSIPPUS, a stoic philosopher, born at Solos in Cilicia, was disciple to Cleanthus, Zeno's successor. He wrote many books, several of which related to logic. None of the philosophers spoke in stronger terms of the fatal necessity of every thing, nor more pompously of the liberty of man, than the Stoics, Chrysippus in particular. He was so considerable among them, as to establish it into a proverb, that if it had not been for Chrysippus, the porch had never been. Yet the Stoics complained, as Cicero relates, that he had collected so many arguments in favour of the sceptical hypothesis, that he could not answer them himself; and thus had furnished Carneades, their antagonist, with weapons against them. There is an apophthegm of this philosopher preserved, which does him honour. Being told that some persons spoke ill of him, "It is no matter (said he), I will live so that they shall not be believed."



CHRYSIS, or GOLDEN-FLY, in natural history: A genus of insects belonging to the order of hymenoptera. The mouth is armed with jaws, but has no proboscis; the antennæ are filiform, bent, and consist of 12 articulations; the abdomen is arched, with a scale on each side; the anus is dentated, and armed with a sting; the wings lie plain; and the body appears as if gilt. There are several species; but the ignita, or flaming chrysis, is beautified with the most resplendent colours. The fore-part of its head is green and gold, and the hinder of a lovely azure. The thorax is likewise azured over, with a mixture of green, and terminates at its extremity with sharp points on both sides. The abdomen is green and gold before, and of a coppery-red behind, imitating molten copper highly polished. The whole insect is dotted on its upper part, which gives it a great resplendency of colour. The antennæ are black, and legs green intermixed with gold. This species dwells in holes of walls between the stones, and in the mortar that cements them. It is often seen issuing from such holes, where it nestles and performs its work. The larvæ, which resemble those of the wasp, likewise inhabit the holes of decayed walls.

CHRYSITRIX, in botany: a genus of the dioecia order, belonging to the polygamia class of plants. In the hermaphrodite the glume is two-valved, the corollæ from chaff numerous and bristly; many stamina, one within each chaff; one pistillum. The male is the hermaphrodite; there is no pistillum.

CHRYSOBALANUS, COCOA PLUM: A genus of the monogynia order, belonging to the icosandria class of plants; and in the natural method ranking under the 36th order, *Pomaceæ.* The calyx is quinquefid, the petals five; plum-kernel five furrowed and five-valved. There is only one species, the icaco, which is a native of the Bahama islands and many other parts of America, but commonly grows near the sea. It rises with a shrubby stalk eight or nine feet high, sending out several side-branches, which are covered with a dark brown bark. The flowers are white, and are succeeded by plums like damsons; some blue, some red, and others yellow. The stone is shaped like a pear, and has five longitudinal furrows. The plums have a sweet luscious taste, and are brought to the tables of the inhabitants, by whom they are much esteemed.

CHRYSOCOMA, GOLDY-LOCKS: A genus of the polygamia æqualis order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ.* The receptacle is na-

naked; the pappus simple; the calyx hemispherical and imbricated; the style hardly longer than the florets. There are nine species, the most remarkable of which are, the linosyris, the coma aurea, and the cornua. These are herbaceous flowering perennials, growing from one to two feet high, ornamented with narrow leaves, and compound flosculous flowers of a yellow colour. They are easily propagated by dividing the roots or by cuttings; but the two last require to be sheltered in the green-house in winter.

CHRYSOGONUM, 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, *Compositæ*. The receptacle is paleaceous; the pappus monophyllous, and tridented; the calyx pentaphyllous; the seeds wrapped up each in a tetraphyllous calyculus, or little cup.

CHRYSOLARUS (Emanuel), one of those learned men in the 14th century who brought the Greek literature into the west. He was a man of rank; and descended from an ancient family, said to have removed with Constantine from Rome to Byzantium. He was sent into Europe by the emperor of the east to implore the assistance of the Christian princes. He afterwards taught at Florence, Venice, Pavia, and Rome; and died at Constantinople, in 1415, aged 47. He wrote a Greek grammar, and some other small pieces.

CHRYSOLITE, or YELLOWISH-GREEN TOPAZ; a precious stone of a grass green colour, found in the East Indies, Brazil, Bohemia, Saxony, Spain, in Auvergne and Bourbon in France, and in Derbyshire in England. Some are likewise found with volcanic lavas, as in the Vevarais, where some large lumps have been seen of 20 or 30 pounds weight; but it is remarkable, that some of these chrysolites are partly decomposed into an argillaceous substance. All chrysolites, however, are far from being of the same kind. The oriental is the same with the peridot, and differs only by its green hue from the sapphires, topazes, and rubies of the same denomination. This becomes electric by being rubbed; has a prismatic form of six, or sometimes of five striated faces; and does not lose its colour or transparency in the fire, which the common chrysolite often does; becoming either opaque, or melting entirely in a strong heat. The instant it melts, it emits a phosphoric light like the basis of alum and gypseous spar: with borax it produces a thin colourless glass. Its specific gravity is between 3.600 and 3.700; according to Brisson it is 2.7821, or 2.6923; and that of the Spanish chrysolite 3.0989.

The substance of this precious stone is lamellated in the direction of the axis of its primitive form: but the chrysolite from Saxony is foliated in a perpendicular direction to the same axis. The chrysolite of the ancients was the same gem which is now called *topaz*, and the name of itself indicates that it ought to be so. Pliny says that the colour of the chrysolite is yellow like gold.

CHRYSOLITE-*Paste*, a kind of glass made in imitation of natural chrysolite, by mixing two ounces of prepared crystal with ten ounces of red-lead, adding 12 grains of crocus martis made with vinegar; and then baking the whole for 24 hours, or longer in a well luted cucurbit.

CHRYSOMELA, in zoology, a genus of insects belonging to the order of coleoptera. The antennæ are shaped like bracelets, and thicker on the outside; and neither the breast nor the elytra are marginated. There are no less than 122 species enumerated by Linnæus, principally distinguished by differences in their colour. They are to be found almost every where, in woods, gardens, &c. Their progressive motion is slow; and some when caught emit an oily liquor of a disagreeable smell. The glittering colours with which several species of Chrysomelæ are adorned, and which seem to exhibit the brilliancy of gold and copper, have occasioned their bearing that pompous name. The larvæ of these insects have in general an oval body, rather oblong and soft; on the fore-part of which are situated six feet, which are scaly, as is also the head. They prey upon the substance of leaves, rejecting the fibrous part. Those of the leaping chrysomelæ infest the cotyledons and tender leaves of plants. Of this genus is that very pernicious insect called by the country people the *turnip fly*, which infests turnips and many crops in the garden, destroying often whole fields while in their seedling leaves. In very hot summers they abound to an amazing degree, and, as you walk in a field or in a garden, make a pattering like rain, by jumping on the leaves of the turnips or cabbages. See Plate CXLIX.



CHRYSOPHYLLUM, or BULLY-TREE: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 43d order, viz. *Dumosæ*. The corolla is campanulated, decemfid, with the segments alternately a little patent. The fruit is a ten-seeded berry. There are two species, the cainito and glabrum, both natives of the West Indies. The first rises 30 or 40 feet high, with a large trunk covered with a brown bark, and divides into many flexible slender branches, which generally hang downward, garnished with spear-shaped leaves, whose under sides are of a bright russet colour. The flowers come out at the extremities of the branches disposed in oblong bunches, which are succeeded by fruit of the size of a golden pippin, that are very rough to the palate, and astringent; but when kept some time mellow, as is practised here with medlars, they have an agreeable flavour. The second sort never rises to the height of the first, nor do the trunks grow to half the size; but the branches are slender and garnished with leaves like those of the first. The flowers come out in clusters from the side of the branches, which are succeeded by oval smooth fruit about the size of a bergamot pear. This contains a white clammy juice when fresh; but after being kept a few days, it becomes sweet, soft, and delicious. Inclosed are four or five black seeds about the size of those of a pomkin. Both these plants are frequently preserved in gardens where there are large stoves, and are propagated by seeds, but the plants can never bear the open air in Britan.

CHRYSOPLENIUM, in botany: a genus of the digynia order, belonging to the decandria class of plants; and in the natural method ranking under the 12th order, *Succulentæ*. The calyx is quadrifid or quinquefid, and coloured; no corolla; the capsule birostrated, unilocular and polyspermous.

CHRYSOPRASUS, or CHRYSOPRASIUS, the 10th of the precious stones mentioned in the Revelations, as forming

forming the foundation of the heavenly Jerufalem. The chryfoprafius is by mineralogifts reckoned to be a variety of the chryfolite, and by Cronftedt called the *yellowifh green and cloudy topaz*. He conjectures that it may perhaps be the fubftance which ferves as a matrix to the chryfolite; as thofe that he had feen were like the clear veined quartz, called in Sweden *milk cryftal*, which is the firft degree of cryftallization.

The chryfoprafus, according to M. Magellan, is of a green colour, deeper than the chryfolite, but with a yellowifh tinge inclining to blue like the green leek. M. Achard fays that it is never found chryftallized, and that it is femitranfparent. By others it is reckoned among the quartz, and its colour is fuppofed to be owing to the mixture of cobalt, as it gives a fine blue glafs when melted with borax, or with fixed alkali. Mr Achard, however, found the glafs of a deep yellow when the fufion was made with borax; and that it really contains fome calx of copper inftead of cobalt. Mr Dutens fays, that fome gold has been found in this kind of ftone: but this laft belongs in all probablity, fays M. Magellan, to another clafs of fubftances, viz. the vitreous fpars.

To the latter belongs moft probably the aventurine, whofe colour is generally a yellow-brown red; though fometimes it inclines more to the yellow, or greenifh, than to the red. Thefe ftones are not quite tranfparent: fome indeed fhine with fuch a brilliancy, as to render them of confiderable value, but they are very rare. The common aventurine is but an artificial glafs of various colours with which powder of gold has been mixed; and thefe imitated aventurines fo frequently excel the native ones in fplendor, that the efteem of the latter is now much lowered. With regard to the chryfoprafus, its name from πρασον, fhows it to be of a greenifh-blue colour, like the leaves of a leek; it only differs from the chryfolite in its bluifh hue.

CHRYSOSTOM (St John), a celebrated patriarch of Conftantinople, and one of the moft admired fathers of the Chriftian church, was born of a noble family at Antioch about the year 347. He ftudied rhetoric under Libavius, and philofophy under Andragathus: after which he fpent fome time in folitude in the mountains near Antioch; but the aufterities he endured having impaired his health, he returned to Antioch, where he was ordained deacon by Meletius. Flavian, Meletius's fucceffor, raifed him to the office of prefbyter five years after; when he diftinguifhed himfelf fo greatly by his eloquence, that he obtained the furname of *Golden mouth*. Nectarius patriarch of Conftantinople, dying in 397, St Chryfoftom, whofe fame was fpread throughout the whole empire, was chofen in his room by the unanimous confent of both the clergy and the people. The emperor Arcadius confirmed this election, and caufed him to leave Antioch privately, where the people were very unwilling to part with him. He was ordained bifhop on the 26th of February 398; when he obtained an order from the emperor againft the Eunomians and Montanifts; reformed the abufes which fubfifted amongft his clergy: retrenched a great part of the expences in which his predeceffors had lived, in order to enable him to feed the poor and build hofpitals; and preached with the utmoft zeal againft the pride, luxury, and avarice of the great. But his pious liberty of fpeech procured him many powerful enemies. He differed with Theophilus of Alexandria, who got him depofed and banifhed; but he was foon recalled. After this, declaiming againft the dedication of a ftatue erected to the emprefs, fhe banifhed him into Cucufus in Armenia, a moft barren unhofpitable place; afterwards, as they were removing him from Petyus, the foldiers treated him fo roughly, that he died by the way, A. D. 407. The beft edition of his works is that publifhed at Paris in 1718, by Mountfaucon.



CHRYSTAL. See CRYSTAL.

CHUB, or CHUBB, in ichthyology. See CYPRINUS.

The reforts of this fifh are eafily found; for they are generally holes, overfhaded by trees, and this fifh will be feen floating in fuch almoft on the furface of the water in a hot day in great numbers. They are but a poor fifh for the table, and are very full of bones; but they entertain the angler very much, and are of the number of thofe that are eafily taken. The beft manner of fifhing for him is thus: prepare a very ftrong rod of a fufficient length; fix to the hook a grafshopper; place yourfelf fo as to be perfectly out of fight of the fifh, and drop in the bait about two feet from the place where a large chub lies; if he does not fee the angler he very feldom fails biting, and is immediately taken; but he is fo ftrong a fifh that he fhould be taken out carefully, after a great deal of playing, otherwife the tackle will be in danger; a beetle, or any large fly, will anfwer the purpofe in the place of a grafshopper; and if none of them are to be had, the method of fifhing muft be altered, and the line be long enough for fifhing at the bottom. In March and April this fifh is to be caught with large red worms; in June and July with flies, fnails, and cherries; but in Auguft and September the proper bait is good cheefe pounded in a mortar, with fome faffron, and a little butter; fome make a pafte of cheefe and Venice turpentine for the chub in winter, at which feafon this fifh is better than at any other; the bones are lefs troublefome in this feafon, and the flefh is more firm and better tafted; the row is alfo well flavoured in general. The angler muft keep this bait for this fifh at the bottom in cold weather, and near the top in hot, and the fifh will bite eagerly.

CHUBB (Thomas), a noted polemical writer, born at Eaft Harnham, a village near Salifbury, England, in 1679. He was put apprentice to a glover at Salifbury, and afterwards entered into partnerfhip with a tallow-chandler. Being a man of ftrong natural parts, he employed all his leifure in reading; and though a ftranger to the learned languages, became tolerably verfed in geography, mathematics, and other branches of fcience. His favourite ftudy was divinity; and he formed a little fociety for the purpofe of debating upon religious fubjects, about the time that the Trinitarian controverfy was fo warmly agitated between Clarke and Waterland. This fubject, therefore, falling under the cognizance of Chubb's theological affembly, he at their requeft drew up and arranged his fentiments on it, in a kind of differtation; which was afterward publifhed under the title of *The Supremacy of the Father afferted*, &c. In this piece Mr Chubb fhowed great talents in reafoning; and acquired fo much

much reputation, that the late Sir Joseph Jekyl, master of the rolls, took him into his family to enjoy his conversation: but though he is said to have been tempted to remain with him by the offer of a genteel allowance, he did not continue with him many years; but chose to return to his friends at Salisbury. He published afterwards a 4to volume of tracts, which Mr Pope informs his friend Gay, he "read through with admiration of the writer, though not always with approbation of his doctrine." He died a single man in the 68th year of his age, and left behind him 2 vols. of posthumous tracts, in which he appears to have had little or no belief in revelation. But however licentious his way of thinking may be deemed, nothing irregular or immoral has been fairly imputed to him in his life and actions.

CHUDLEIGH (Lady Mary), was born in 1656, and married to Sir George Chudleigh, baronet, by whom she had several children: her poems and essays have been much admired for delicacy of style. She died in 1710; and is said to have written several dramatic pieces, which, though not printed, are preserved in the family.

CHUPMESSAHITES, a sect among the Mahometans, who believe that Jesus Christ is God, and the true Messiah, the Redeemer of the world; but without rendering him any public or declared worship. The word in the Turkish language signifies *protector of the Christians*. Ricaut says, there are abundance of these Chupmessahites among the people of fashion in Turkey, and some even in the seraglio.

CHURCH, has different significations, according to the different subjects to which it is applied.

1. It is understood of the collective body of Christians, or all those over the face of the whole earth who profess to believe in Christ, and acknowledge him to be the Saviour of mankind. This is what the ancient writers call the *catholic* or *universal church*. Sometimes the word church is considered in a more extensive sense, and divided into several branches; as the church militant is the assembly of the faithful upon earth; the church triumphant, that of the faithful already in glory; to which the Papists add the church patient; which, according to their doctrines, is that of the faithful in purgatory.

2. Church is applied to any particular congregation of Christians, who associate together and concur in the participation of all the institutions of Jesus Christ, with their proper pastors and ministers. Thus we read of the church of Antioch, the church of Alexandria, the church of Thessalonica, and the like.

3. Church denotes a particular sect of Christians distinguished by particular doctrines and ceremonies. In this sense we speak of the Romish church, the Greek church, the Reformed church, the church of England, &c.

The Latin or Western church, comprehends all the churches of Italy, France, Spain, Africa, the north, and all other countries whither the Romans carried their language. Great Britain, part of the Netherlands, of Germany, and of the North, have been separated from hence ever since the time of Henry VIII.; and constitute what we call the Reformed church, and what the Romanists call the western schism.

The Greek or Eastern church, comprehends the churches of all the countries anciently subject to the Greek or eastern empire, and through which their language was carried; that is, all the space extended from Greece to Mesopotamia and Persia, and thence into Egypt. This church has been divided from the Roman, ever since the time of the emperor Phocas.

The Gallican church, denotes the church of France, under the government and direction of their respective bishops and pastors. This church has always enjoyed certain franchises and immunities; not as grants from popes, but as derived to her from her first original, and which she has taken care never to relinquish. These liberties depend upon two maxims; the first, that the pope has no authority or right to command or order any thing either in general or in particular, in which the temporalities and civil rights of the kingdom are concerned; the second, that notwithstanding the pope's supremacy is owned in cases purely spiritual, yet in France his power is limited and regulated by the decrees and canons of ancient councils received in that realm.

4. The word church is used to signify the body of ecclesiastics, or the clergy, in contradistinction to the laity. See CLERGY.

5. Church is used for the place where a particular congregation or society of Christians assemble for the celebration of divine service. In this sense churches are variously denominated, according to the rank, degree, discipline, &c. as Metropolitan church, Patriarchal church, Cathedral church, Parochial church, Collegiate church, &c. See METROPOLIS, PATRIARCH, &c.

In ecclesiastical writers, we meet with *grand church*, for the chief church of a place; particularly in the Greek lithurgy, for the church of St Sophia at Constantinople, the see of the patriarch, founded by Constantine, and consecrated under Justinian. It was at that time so magnificent, that Justinian is said to have cried out in the consecration thereof, Ενικησα σε, Σολομον; *I have outdone thee, Solomon*. The dome, which is said to have been the first that was built, is 330 feet diameter.

The first church publicly built by the Christians, some authors maintain to be that of St Saviour at Rome, founded by Constantine; others contend, that several churches abroad, called by the name of *St Peter Vivus*, were built in honour of that apostle during his life-time.

CHURCH, with regard to architecture, Daviler defines a large oblong edifice, in form of a ship, with nave, choir, isles, chapel, belfry, &c. See each part under its proper head.

*CHURCH, simple*, is that which has only a nave and a choir.

*CHURCH with Isles*, that which has a row of porticos, in form of vaulted galleries, with chapels in its circumference.

*CHURCH in a Greek cross*, that where the length of the traverse part is equal to that of the nave; so called because most of the Greek churches are built in this form.

*CHURCH in a Latin cross*, that whose nave is longer than the cross part, as in most of the Gothic churches.

*CHURCH in Rotundo*, that whose plan is a perfect circle, in imitation of the Pantheon.



For

For the form of the ancient Greek churches, when they had all their parts, it was as follows: first was a porch, or portico, called the *vaunt-nave*, προναος: this was adorned with columns on the outside, and on the inside surrounded with a wall; in the middle whereof was a door, through which they passed into a second portico. The first of these porticos was destined for *the energumeni*, and penitents in the first stage of their repentance; the second was much longer, destined for penitents of the second class, and the catechumens, and hence called ναρθηξ, *ferula*, because those placed in it began to be subject to the discipline of the church. These two porticos took up about one-third of the space of the church. From the second portico, they passed into the nave, ναος, which took up near another third of the church. In the middle, or at one side of the nave, was the ambo, where the deacons and priests read the gospel, and preached. The nave was destined for the reception of the people, who here assisted at prayers.

Near the entrance of this was the baptistery or font. Beyond the nave was the choir, χορος, set with seats, and round: the first seat on the right, next the sanctuary, being for the chantor, or *choragus*.

From the choir they ascended by steps to the sanctuary, which was entered at three doors. The sanctuary had three apsides in its length; a great one in the middle under which was the altar, crowned with a baldachin, supported by four columns. Under each of the small apsides, was a kind of table or cupboard, in manner of a beaufet.

Though, of the Greek churches now remaining, few have all the parts above described, most of them having been reduced to ruins or converted into mosques.

*High-CHURCH* was a denomination originally given to those otherwise called *Non-jurors*, who refused to acknowledge the title of William III. to the crown of Great Britain, under a notion that James II. though excluded, was still their rightful sovereign. This appellation was given them, because they entertained high notions of the dignity and power of the church, and the extent of its prerogative and jurisdiction. And those, on the contrary, were called *low-church men*, who disapproved of the secession and obstinacy of the non-jurors, distinguished themselves by their moderation toward dissenters, and were less ardent in extending the limits of church authority. The denomination of *high-church men* is now more generally applied to all who form pompous and ambitious conceptions of the authority and jurisdiction of the church, and who would raise it to an absolute independence on all human power.

*CHURCH-Ale.* See *WHITSUN-Ale.*

*CHURCH-Reeves*, the same with *CHURCH-Wardens.*

*CHURCH-Scot*, or *Churchesset*, a payment or contribution, by the Latin writers frequently called *primitiæ seminum;* being, at first, a certain measure of wheat, paid to the priest on St Martin's day, as the first fruits of harvest. This was enjoined by the laws of king Malcom IV. and Canute, c. 10. But after this, *Church-scot* came to signify a reserve of corn-rent paid to the secular priests, or to the religious; and sometimes was taken in so general a sense as to include poultry, or any other provision that was paid in kind to the religious. See TITHE.



*CHURCH-Wardens* (*ecclesiæ guardiani*), in the English ecclesiastical polity, are the guardians or keepers of the church, and representatives of the body of the parish. They are sometimes appointed by the minister, sometimes by the parish, sometimes by both together, as custom directs. They are taken, in favour of the church, to be, for some purposes, a kind of corporation at the common law; that is, they are enabled, by that name, to have a property in goods and chattels, and to bring actions for them, for the use and profit of the parish. Yet they may not waste the church goods, but may be removed by the parish, and then called to account by actions at common law: but there is no method of calling them to account but by first removing them; for none can legally do it but those who are put in their place. As to lands or other real property, as the church, church-yard, &c. they have no sort of interest therein; but if any damage is done thereto, the person only or vicar shall have the action. Their office also is to repair the church, and make rates and levies for that purpose: but these are recoverable only in the ecclesiastical courts. They are also joined with the overseers in the care and maintenance of the poor. They are to levy a shilling forfeiture on all such as do not repair to church on Sundays and holidays; and are empowered to keep all persons orderly while there; to which end it has been held that a church-warden may justify the pulling off a man's hat, without being guilty of either an assault or a trespass. There are also a multitude of other petty parochial powers committed to their charge by divers acts of parliament.

CHURCHILL (Sir Winston), the father of the great duke of Marlborough, was descended from an ancient and honourable family in Dorsetshire. He was born at Wotton Glanvile in that county in 1610; and educated at St John's college at Oxford. He engaged in the cause of his unfortunate sovereign Cha. I. for which he suffered severely in his fortune; and having married while young, Elizabeth, the daughter of Sir John Drake of Ashe in Devonshire, she was forced to seek a refuge in her father's house, when Mr Churchill's misfortunes left him none that he could call his own; and there most of his children were born. After the restoration, he was elected a burgess to serve in parliament for the borough of Weymouth; and, in 1669, his majesty was pleased to confer on him the honour of knighthood. The next year he was made one of the commissioners of claims in Ireland; and upon his return from thence, was constituted one of the clerks comptrollers of the green-cloth: but writing a kind of political essay upon the History of England, which gave great offence to the parliament, he was, in 1678, dismissed from his post. He was, however, soon restored to it again; and lived to see his eldest surviving son raised to the peerage, and the rest of his children in a fair way to promotion. He died in 1688.

CHURCHILL (John) Duke of Marlborough, and prince of the holy Roman empire, a most renowned general and statesman, was born at Ashe in Devonshire in 1650. He was eldest son of Sir Winston Churchill, who carried him to court while very young, and where he was particularly favoured by James duke of York, afterwards king James II. when only

Churchill. twelve years of age. In 1666, he was made an ensign of the guards during the first Dutch war; and afterwards improved himself greatly in the military art at Tangier. In 1672, Mr Churchill attended the duke of Monmouth who commanded a body of auxiliaries in the French service, and was soon after made a captain in the duke's own regiment. At the siege of Nimeguen, which happened in that campaign, he distinguished himself so much that he was taken notice of by the celebrated marshal Turenne, who bestowed on him the name of the *handsome Englishman*.—In 1673 he was at the siege of Maestricht, where he gained such applause, that the king of France made him a public acknowledgment of his service; and the duke of Monmouth, who had the direction of the attack, told king Charles II. that he owed his life to Mr Churchill's bravery. In 1681, he married Sarah daughter and co-heiress (with her sister the countess of Tyrconnel) of Richard Jenning, Esq; of Sandrich, in Hertfordshire. The duke of York recommended him in a very particular manner to the king: who, in 1682, created him baron of Eymouth in the county of Berwick in Scotland, and made him colonel of the third troop of guards. A little after king James's accession, he was created baron Churchill of Sandrich in the county of Hertford, and made brigadier-general of his majesty's army in the west; where, when the duke of Monmouth came to surprise the king's army, while the earl of Feversham and the majority of the officers were in their beds, he kept the enemy in play till the king's forces had formed themselves, and thereby saved the whole army. When James showed an intention of establishing the catholic religion in Britain, lord Churchill, notwithstanding the great obligations he owed him, thought it his duty to abandon the royal cause; but even then did not leave him without acquainting him by letter with the reason of his so doing. Lord Churchill was graciously received by the prince of Orange; and was by him employed first to re-assemble the troop of guards at London, and afterwards to reduce some lately raised regiments, and to new-model the army; for which purpose he was invested with the rank and title of lieutenant-general. In 1689, he was sworn one of the privy council, and one of the gentlemen of the king's bed-chamber; and on the 9th of April following, was raised to the dignity of earl of Marlborough in the county of Wilts. He assisted at the coronation of their majesties; and was soon after made commander in chief of the English forces sent over to Holland; and here he first laid the foundation of that fame which was afterwards spread over all Europe. In 1690, he was made general of the forces sent to Ireland: where he made the strong garrisons of Cork and Kinsale prisoners of war. The year following, king William showed the good opinion he had of his conduct, by sending him to Flanders to put all things in readiness, and to draw the army together against his arrival. In 1692, he was dismissed from all his employments; and, not long after, was with some other peers committed to the tower on an accusation of high treason; which, however, was afterwards found to be a false and malicious report, the authors of which were punished. Marlborough was soon restored to favour, and in 1698 was appointed governor to the earl of Gloucester; with this extraordinary compliment from king William, "My lord, make him but what you are, and my nephew will be all I wish to see him." The same day he was again sworn one of the privy council; and in July following was declared one of the lord justices of England, for the administration of the government, in which great trust he was three times successively in the king's absence. In 1701 he was appointed general of the foot, commander in chief of the English forces, and ambassador extraordinary and plenipotentiary at the Hague. Upon the accession of queen Anne to the throne, he was elected into the order of the garter, declared captain-general of all her majesty's forces, and sent ambassador extraordinary and plenipotentiary to Holland. After several conferences about a war, he put himself at the head of the army, where all the other generals had orders to obey him. His exploits in the field have been taken notice of under the article BRITAIN, n° 349—370: we shall therefore only take notice in this place, of the rewards and honours conferred upon him for these exploits. After this first campaign he was created marquis of Blandford and duke of Marlborough, with a pension of L. 5000 out of the post-office, to devolve for ever upon those enjoying the title of Duke of Marlborough. In 1703, he met Charles III. late emperor, going to Spain, who presented him with a sword set with diamonds. In 1704, having forced the enemy's lines at Schellenberg, he received a letter of thanks from the emperor Leopold, written with his own hand; an honour seldom done to any but sovereign princes. After the battle of Blenheim, he received congratulatory letters from most of the potentates in Europe, particularly from the States General, and from the emperor, who desired him to accept of the dignity of a prince of the empire, which with the queen's leave was conferred upon him by the title of *Prince of Mildenheim in the province of Swabia*. After the campaign was ended, he visited the court of Prussia, where he laid such schemes as suspended the disputes with the Dutch about king William's estate; which wise conduct caused the whole confederacy to acknowledge that he had done the greatest service possible to the common cause. Upon his return to England, the queen, to perpetuate his memory, granted the interest of the crown in the honour and manor of Woodstock and hundred of Wotton to him and his heirs for ever. In 1705 he made a tour to Vienna, upon an invitation of the emperor Joseph; who highly caressed him, and made him a grant of the lordship of Mildenheim. After the campaign of 1708, the speaker of the house of commons was sent to Brussels on purpose to compliment him; and on his return to England he was again complimented in the house of lords by lord chancellor Cowper. All his services, however, and all the honours conferred upon him, were not sufficient to preserve him from being disgraced. After the change of the ministry in 1710, his interest daily declined; and in 1712, on the first day of the new year, he was removed from all his places. Finding all arts used to render him obnoxious in his native country, he visited his principality of Mildenheim, and several towns in Germany; after which he returned to England, and arrived there on the day of the queen's death. After being welcomed by the nobility and foreign ministers, he

Churchill. he attended on king George I. in his public entry through London, who appointed him captain-general, colonel of the first regiment of foot-guards, one of the commissioners for the government of Chelsea hospital, and master-general of the ordnance. Some years before his death, he retired from public business. He died at Windsor-lodge in 1722, aged 73; leaving behind him a very numerous posterity, allied to the noblest and greatest families in the three kingdoms. Upon his demise all parties united in doing honour or rather justice to his merit, and his corpse was interred the 9th of August following, with all the solemnity due to a person who had deserved so highly of his country, in Westminster-abbey. The noble pile near Woodstock, which bears the name of Blenheim-house, may be justly styled his monument; but without pretending to the gift of prophecy, one may venture to foretel, that his glory will long survive that structure; and that so long as British histories remain, or indeed the histories of Europe, his memory will live and be the boast of Britain, which by his labours was raised to be the first of nations, as during the age in which he lived he was deservedly esteemed the first of men. If he had foibles, as these are inseparable from human nature, they were so hidden by the glare of his virtues as to be scarcely perceived or were willingly forgotten. A certain parasite, who thought to please Lord Bolingbroke by ridiculing the avarice of the Duke, was stopt short by his Lordship; who said, "He was so very great a man, that I forget he had that vice."

Out of a variety of anecdotes and testimonies concerning this illustrious personage, collected in the new edition of the *Biographia Britannica*, the following selection may serve to illustrate more particularly his disposition and manners.

One of the first things which he did, when very young, was to purchase a box to put his money in; an indication this of the economical, not to say avaricious, temper that accompanied him through life. Dr Joseph Warton relates, that, on the evening of an important battle, the duke was heard to chide his servant for having been so extravagant as to light four candles in his tent when Prince Eugene came to confer with him. Mr Tyers, on the other hand, mentioned a circumstance which, if well founded, redounds to his grace's generosity, though in a different respect it is much to his discredit: It is, that during the rebellion 1715 he sent L 10,000 to the earl of Mar. We consider the story as only a traditional report, which has not in itself any great degree of probability; and therefore we are by no means convinced of its truth. The late Mr Richardson junior, the painter, hath recorded a pleasing instance of the duke's calmness of disposition; for which, indeed, he was always remarkable. "The duke of Marlborough (says the writer), riding out once with Commissary Marriot, near the commissary's house in the country, it began to rain, and the duke called for his cloak; Marriot having his put on by his servant immediately. The duke's servant not bringing the cloak, he called for it again; but the man was still puzzling about the straps and buckles. At last, it raining now very hard, the duke called again, and asked him, 'what he was about that he did not bring his cloak?' 'You must stay (grumbles the fellow), if it rains cats and dogs, till I can get at it.' The duke only turned to Marriot, and said, 'I would not be of that fellow's temper." The duke of Marlborough (adds Mr Richardson) did by nature and constitution, what Seneca judged by philosophy ought to be done. *Quid est quare ego servi mei hilarius responsum, et contumaciorem vultum, flagellis et compedibus expiem?*

Dr Swift, in one of his letters to Stella, relates the following particulars concerning the duke of Marlborough. "I was early this morning with secretary St John, and gave him a memorial to get the queen's letter for the first-fruits, who has promised to do it in a very few days. He told me 'he had been with the duke of Marlborough, who was lamenting his former wrong steps in joining with the Whigs, and said he was worn out with age, fatigue, and misfortunes.' I swear it pitied me; and I really think they will not do well in too much mortifying that man, although indeed it is his own fault. He is covetous as hell, and ambitious as the prince of it: he would fain have been general for life, and has broken all endeavours for peace, to keep his greatness, and get money. He told the queen 'he was neither covetous nor ambitious.' She said, 'if she could have conveniently turned about, she should have laughed, and could hardly forbear it in his face.' He fell in with all the abominable measures of the late ministry, because they gratified him for their own designs. Yet he has been a successful general, and I hope he will continue his command."

Various characters have been drawn of the duke of Marlborough; most of which we shall omit, as either already sufficiently known, or as not meriting particular notice. That which is given of him by Dr Swift, in his "History of the four last years of the queen," has all the malignity and meanness of a party pamphlet. It is even so foolish as to insinuate, that the duke's military accomplishments were problematical, and that he was destitute of personal courage. Mr Macpherson's character of his grace is very elaborately composed, and displays no small degree of ability and penetration; though it is not, perhaps, entirely free from prejudice. The historian considers it as a fact, that lord Churchill, at the time of the Revolution, had a design of placing his unfortunate master king James II. a prisoner in the hands of his rival the prince of Orange. But this story must be regarded as wholly unworthy of credit. It is founded upon suggestions and informations so groundless, and even ridiculous, that it cannot deserve a formal refutation. On the other hand, Mr Macpherson has done justice to the duke of Marlborough's prosecution of the war in Flanders, and hath shown that he conducted it upon the principles of sound wisdom and good policy.

There are two testimonies to the honour of the duke's memory, by two celebrated noble writers, which cannot be passed over. One is by lord Bolingbroke, in his letters on the Study and Use of History. Speaking of the consternation raised among the allies of the grand confederacy by the death of king William, and of the joy which that event gave to the French, his lordship observes, that "a short time showed how vain the fears of some and the hopes of others were. By his death, the duke of Marlborough was raised to the head of the army, and indeed of the con-

Churchill.

confederacy: where he, a new, a private man, a subject, acquired, by merit and by management, a more decided influence than high birth, confirmed authority, and even the crown of Great Britain, had given to king William. Not only all the parts of that vast machine, the grand alliance, were kept more compact and entire, but a more rapid and vigorous motion was given to the whole: and, instead of languishing out disastrous campaigns, we saw every scene of the war full of action. All those wherein he appeared, and many of those wherein he was not then an actor, but abbettor however of their action, were crowned with the most triumphant success. I take, with pleasure, this opportunity in doing justice to that great man, whose faults I knew, whose virtues I admired; and whose memory, as the greatest general, and as the greatest minister, that our country, or perhaps any other, has produced, I honour."

The other testimony to the duke's accomplishments is by the earl of Chesterfield, in his Letters to his Son, "Of all the men (says his lordship) that ever I knew in my life (and I knew him extremely well), the late duke of Marlborough possessed the graces in the highest degree, not to say engrossed them: and indeed he got the most by them; for I will venture (contrary to the custom of profound historians, who always assign deep causes for great events) to ascribe the better half of the duke of Marlborough's greatness and riches to those graces. He was eminently illiterate: wrote bad English, and spelled it still worse. He had no share of what is commonly called *parts;* that is, he had no brightness, nothing shining in his genius. He had, most undoubtedly, an excellent good plain understanding, with sound judgment. But these alone would probably have raised him but something higher than they found him; which was page to king James II.'s queen. There the graces protected and promoted him: for while he was an ensign of the guards, the duchess of Cleveland, then favourite mistress to king Charles II. struck by those very graces, gave him L.5000; with which he immediately bought an annuity for his life of L.500 a-year, of my grandfather Halifax; which was the foundation of his subsequent fortune. His figure was beautiful; but his manner was irresistable, by either man or woman. It was by this engaging graceful manner that he was enabled, during all his war, to connect the various jarring powers of the grand alliance, and to carry them on to the main object of the war, notwithstanding their private and separate views, jealousies, and wrongheadednesses. Whatever court he went to (and he was often obliged to go himself to some testy and refractory ones), he as constantly prevailed, and brought them into his measures. The pensionary Heinsius, a venerable old minister, grown grey in business, and who had governed the republic of the United Provinces for more than 40 years, was absolutely governed by the duke of Marlborough, as that republic feels to this day. He was always cool, and nobody ever observed the least variation in his countenance: he could refuse more gracefully than other people could grant; and those who went away from him the most dissatisfied as to the substance of their business, were yet personally charmed with him, and in some degree comforted by his manner. With all his gentleness and gracefulness, no man living was more conscious of his situation, nor maintained his dignity better."

Churchill.

A perusal of the above passage will convince us of the frivolous turn of the earl of Chesterfield's mind. His lordship, in his zeal to exalt the duke of Marlborough's external accomplishments, either forgets or depreciates the far greater talents of which he was possessed. There is an observation upon the subject in the British Biography, with which we entirely concur. "That the duke of Marlborough (says the writer) was eminently distinguished by the gracefulness of his manners, cannot be questioned: but the earl of Chesterfield appears to have attributed too much to their influence, when he ascribes—the better half of the duke of Marlborough's greatness and riches to those graces. That the uncommon gracefulness of his manners facilitated his advancement, and contributed to the success of his negociations, may readily be admitted; but surely it must have been to much higher qualities that he owed the esteem of king William and of prince Eugene, his reputation throughout all Europe, and his many victories and conquests. It was not by a polite exterior that he obtained his laurels at Scheilenberg, at Oudenarde, at Ramillies, and at Blenheim."

How much the duke of Marlborough has been celebrated by our poets, is well known by Addison's "Campaign," and Philips "Blenheim." Mr Addison, in his Rosamond, has properly assumed another and voluntary occasion of paying a fine compliment to his grace's military expoits, and the glory by which they would be followed. Upon the duke's removal from his places, an ode was inscribed to him by Mr Somerville, animated with all the zeal of whiggish enthusiasm, and containing some passages that are truly poetical. Another ode, not much inferior in spirit, was addressed to his grace, on occasion of his embarking for Ostend in the year 1712.

The duke of Marlborough's Scots title of Baron Eymouth, being to heirs-male, died with himself; but his English title going to his daughters and their heirs-male went into the Spencer family, who retain their own surname of Spencer.

Churchill (Charles), a celebrated satirist, the son of Mr Charles Churchill curate and lecturer of St John's, Westminster, was educated at Westminster school, and received some applause for his abilities from his tutors in that famous seminary. His capacity, however, was greater than his application, so that he acquired the character of a boy that could do good if he would. As the slightest accounts of persons so noted are agreeable, it may not be amiss to observe, that having one day got an exercise to make, and from idleness or inattention having failed to bring it at the time appointed, his master thought proper to chastise him with some severity, and even reproached his stupidity; what the fear of stripes could not effect, the fear of shame soon produced, and he brought his exercise the next day, finished in such a manner, that he received the public thanks of all the masters. Still, however, his progress in the learned languages was but slow; nor is it to be wondered at, if we consider how difficult it was for a strong imagination, such as he was possessed of, to conform and walk tamely forward in the trammels of a school education: minds like

Churchill. like his are ever starting aside after new pursuits; desirous of embracing a multiplicity of amusing objects; eager to come at the end, without the painful investigation of the means. In short, for want of proper skill in these languages, he was rejected from Oxford, whither his father had sent him; and probably this might have given occasion to the frequent invectives we find in his works against that most respectable university. Upon his return from thence, he again applied to his studies in Westminster school, where, at 17 years of age, he contracted an intimacy with a lady, to whom he was married, and their mutual regard for each other continued for several years. At the usual age of going into orders, Mr Churchill was ordained by the late bishop of London, and obtained a small curacy in Wales of L.30 a-year. Thither he carried his wife: they took a small house; and he passed through the duties of his station with assiduity and cheerfulness. Happy had it been for him had he continued there to enjoy the fruits of piety, peace, and simplicity of manners. He was beloved and esteemed by his parishioners; and though his sermons were rather above the level of his audience, they were commended and followed. But endeavouring to advance his fortune, by keeping a cyder cellar, it involved him in difficulties which obliged him to leave Wales and come to London. His father dying soon after, he stepped into the church in which he had officiated; and, in order to improve his income, which scarcely produced L.100 a year, he taught young ladies to read and write English at a boarding school, kept by Mrs Dennis, where he behaved with that decency and decorum which became his profession. His method of living, however, bearing no proportion to his income, he contracted several debts in the city; which being unable to pay, a jail, the terror of indigent genius, seemed ready to complete his misfortunes: but from this state of wretchedness he was relieved by the benevolence of Mr Lloyd, father to the poet of that name. Mean while, Mr Lloyd, the son, wrote a poetical epistle called the *Actor*; which being read and approved by the public, gave the author a distinguished place among the writers of his age. This induced Mr Churchill to write the *Rosciad*. It first came out without the author's name; but the justness of the remarks, and the severity of the satire, soon excited public curiosity. Though he never disowned his having written this piece, and even openly gloried in it; yet the public, unwilling to give so much merit to one alone, ascribed it to a combination of wits: nor were Messrs Lloyd, Thornton, or Colman, left unnamed upon this occasion. This misplaced praise soon induced Mr Churchill to throw off the mask, and the second edition appeared with his name at full length. As the Rosciad was the first of this poet's performances, so many are of opinion that it is the best. In it we find a very close and minute discussion of the particular merit of each performer; their defects pointed out with candour, and their merits praised without adulation. This poem, however, seems to be one of those few works which are injured by succeeding editions: when he became popular, his judgment, began to grow drunk with applause; and we find, in the latter editions, men blamed whose merit is incontestable, and others praised that were at that time in no degree of esteem with the judicious. His next performance was his *Apology to the Critical Reviewers*. This work is not without its peculiar merit; and as it was written against a set of critics whom the world was willing enough to blame, the public read it with their usual indulgence. In this performance he showed a particular happiness of throwing his thoughts, if we may so express it, into poetical paragraphs; so that the sentence swells to the break or conclusion, as we find in prose.

Churchill, Churching.

But while his writings amused the town, his actions disgusted it. He now quitted his wife, with whom he had cohabited many years; and resigning his gown and all clerical functions, commenced a complete *man of the town*, got drunk, frequented stews; and, giddy with false praise, thought his talents a sufficient atonement for all his follies. In some measure to palliate the absurdities of his conduct, he now undertook a poem called *Night*, written upon a general subject indeed, but upon false principles; namely, that whatever our follies are, we should never attempt to conceal them. This, and Mr Churchill's other poems, being shown to Dr Johnson, and his opinion being asked, he allowed them but little merit; which being told to the author, he resolved to requite this private opinion with a public one. In his next poem, therefore, of the *Ghost*, he has drawn this gentleman under the character of Pomposo; and those who disliked Mr Johnson allowed it to have merit. Mr Johnson's only reply to Churchill's abuse was, "that he thought him a shallow fellow in the beginning, and could say nothing worse of him still." The poems of Night and the Ghost had not the rapid sale the author expected; but, his *Prophecy of Famine* soon made ample amends for the late paroxysm in his fame. In this piece, written in the spirit of the famous North Briton, he exerted his virulent pen against the whole Scotch nation; adopting the prejudices of the mob, and dignifying scurrility by the aid of a poetic imagination. It had a rapid and extensive sale, as prophesied by Mr Wilkes; who said, before its publication, that he was sure it must take, as it was at once personal, poetical, and political. After its appearance, it was even asserted by his admirers, that Mr Churchill was a better Poet than Pope. This exaggerated adulation, as it had before corrupted his morals, began now to impair his mind: several succeeding pieces were published, which, being written without effort, are read without pleasure. His *Gotham*, *Independence*, *The Times*, seem merely to have been written by a man who desired to avail himself of the avidity of the public curiosity in his favour, and are rather aimed at the pockets than the hearts of his readers.—Mr Churchill died in 1764, of a miliary fever, with which he was seized at Boulogne in France, whither he had gone on a visit to Mr Wilkes. After his death his poems were collected and printed together in two volumes 8vo.

CHURCHING OF WOMEN AFTER CHILD-BIRTH, took its rise from the Jewish rite of purification. In the Greek church it was limited to the fortieth day after delivery; but in the western parts of Europe no certain time is observed. There is an office in the liturgy for this purpose.

CHURCHYARD, a piece of ground adjoining to a church, set apart for interment or burial of the dead. —In the church of Rome they are blessed or consecrated with great solemnity. If a churchyard, which has been thus consecrated, shall afterwards be polluted by any indecent action, or profaned by the burial of an infidel, an heretic, an excommunicated or unbaptized person, it must be *reconciled;* and the ceremony of the reconciliation is performed with the same solemnity as that of the blessing or consecration.

CHURCHYARD (Thomas), a poet who flourished in the reigns of Henry VIII. Edward VI. queen Mary and queen Elizabeth, was born at Shrewsbury; and inherited a fortune, which he soon exhausted in a fruitless attendance on the court, by which he only gained the favour of being retained a domestic, in the family of lord Surrey; when, by his lordship's encouragement, he commenced poet. Upon his patron's death, he betook himself to arms; was in many engagements; was frequently wounded, and was twice made prisoner. He published 12 pieces, which he afterwards printed together in one volume, under the title of *Churchyard's Chips;* and also the tragedy of Thomas Moubray duke of Norfolk. He died in 1570.

CHURLE, CEORLE, or CARL, in the Saxon times, signified a tenant at will, who held of the thanes on condition of rent and service. They were of two sorts: one rented the estate like our farmers; the other tilled and manured the demesnes, and were called ploughmen. See CEORLE.

CHURNING, in country affairs, the operation of making butter by agitating milk in a well known vessel called a churn. For accelerating this operation, a correspondent in the Bath Society Papers recommends a little distilled vinegar to be poured into the churn; and the butter will be produced in an hour afterwards. He acknowledges, however, that his experiments have not as yet ascertained the exact quantity of the acid which is necessary to the proper effect, nor the precise time of its being mixed with the cream. But he apprehends a table spoonful or two to a gallon of cream will be sufficient; nor would he recommend it to be applied till the cream has undergone some considerable agitation. His first trial was after the churning had been going forward half a day: whether he observed the same rule afterwards, he does not say; but all his trials proved successful, the butter being uniformly obtained in about an hour after the mixture.

CHUS, or *Chusch*, (Bible.) It is a tradition of an ancient standing, that the *Chus* of the Scriptures denotes *Ethiopia*, and *Chuschi* an *Ethiopian:* the Septuagint and Vulgate constantly translate it so; and in this they are followed by most interpreters, and by Josephus and Jerome. And yet what Bochart urges to the contrary is of no inconsiderable weight, from Ezekiel xxix. 10. in which the two opposite extremes of Egypt are designed; and therefore *Chus*, which is opposite to Syene, must be Arabia: but this is more strongly pointed out by Xenophon, by whom Ethiopia is said to be the south boundary of Cyrus's empire; and Herodotus distinguishes between the Ethiopians of Asia and Africa, conjoining the former with the Arabians.

CHYLE, in the animal economy, a milky fluid secreted from the aliments by means of digestion. See ANATOMY, p. 734, 735.

CHYLIFICATION, the formation of the chyle, or the act whereby the food is changed into chyle.

The chyle has by some authors been thought to have a great resemblance in its nature and chemical analysis to milk. The subject, however, hath as yet been but little inquired into. See the article MILK.

CHYME, or CHYMUS, in the common signification of the word, denotes every kind of humour which is incrassated by concoction; under which notion it comprehends all the humours fit or unfit for preserving and nourishing the body, whether good or bad. It frequently imports the finest part of the chyle, when separated from the fæces, and contained in the lacteal and thoracic duct.

CHYMISTRY. See CHEMISTRY.

CHYMOLOGI, an appellation given to such naturalists as have employed their time in investigating the properties of plants from their taste and smell.

CHYMOSIS, in medicine, the act of making or preparing chyme. The word comes from χυμος, *succus*, of χεω, *fundo*, "I melt." Chymosis, according to some, is the second of the concoctions made in the body; being a repeated preparation of the most impure and gross parts of the chyle, which being rejected by the lacteals, is imbibed by the meseraics, and thence carried to the liver, to be there elaborated, purified, and subtilized afresh. It is of this, according to Rogers, that the animal spirits are formed.

CHYMOSIS is also a distortion of the eye-lids, arising from an inflammation; also an inflammation of the tunica cornea in the eye.

CHYTLA, in antiquity, a liquor made of wine and oil, and sometimes used in divination.

CHYTRI, among the Athenians, a festival in honour of Bacchus and Mercury, kept on the 13th of the month Anthesterion.

CHYTRIUM (anc. geog.) a place in Ionia, in which formerly stood Clazomene; the Clazomenians through fear of the Persians, removing from the continent to an adjacent island (Pausanias). Alexander reduced the island, by a mole or causeway, to a peninsula.

CHYTRUS (anc. geog.), an inland town of Cyprus, to the north of Citium: famous for its excellent honey.

CIANUS SINUS, (anc. geog.), a bay of Bithynia, named from the town and river Cius.

CIBALÆ, or CIBALIS, (anc. geog.), a town of Pannonia Inferior, on an eminence, near the lake Hiulka, to the north-west of Sirmium; the country of the emperor Gratian, where he was brought up to rope-making: a place rendered famous for the surprisal and defeat of Licinius by Constantine.

CIBBER (Colley), a celebrated comedian, dramatic writer, and poet laureat to the king, was born at London in 1671. His father Caius Gabriel Cibber, was a native of Holstein, and a skilful statuary, who executed the basso relievo on the pedestal of the monument, and the two admired figures of lunatics over the piers of the gate to Bethlem Hospital in Moorfields. Colley, who derived his Christian name from the surname of his mother's family, was intended for the church, but betook himself to the stage, for which he conceived an early inclination; and he was some time before he acquired any degree of notice, or even a competent salary. His first essay in writing, was the comedy of *Love's last Shift*, acted in 1695, which met with success: as did his own performance of the character of the fop in it. From that time, as he says himself, "My muse and my spouse were so equally prolific, that the one was seldom the mother of a child, but in the same year the other made me the father of a play. I think we had a dozen of each sort between us; of both which kinds some died in their infancy, and near an equal number of each were alive when we quitted the theatre." The *Careless Husband*, acted in 1704, met with great applause, and is reckoned his best play; but none was of more importance to him than the *Non-juror*, acted in 1718, and levelled against the Jacobites. This laid the foundation of the misunderstanding betweeen him and Mr Pope, raised him to be the hero of the Dunciad, and made him poet laureat in 1730. He then quitted the stage, except a few occasional performances; and died in 1757. Cibber neither succeeded in acting nor in writing tragedy; and his odes were not thought to partake of the genius or spirit he showed in his comedies.

His son *Theophilus*, also a comic actor after him, was born during a great storm in 1703; and after passing a life of extravagance, distress, and perplexity, perished in another storm in 1758, in the passage between Dublin and England. Theophilus married the sister of Thomas Augustin Arne, the famous musical composer; who became a celebrated tragic actress, and whose honour was sacrificed to her husband's extravagance.

CIBDELOPLACIA, in natural history; a genus of spars debased by a very large admixture of earth; they are opaque, formed of thin crusts, covering vegetables and other bodies, by way of incrustrations.

Of this genus we have the following species: 1. A greyish-white one, with a rough surface. 2. A whitish brown one: both these are friable. 3. A hard, pale-brown kind, which is the osteocolla of the shops. 4. The whitish grey kind, with a smooth surface: this is the unicornu fossile and ceratites of authors 5. The whitish brown corralloide kind.

CIBDELOSTRACIA, in natural history, terrene spars, destitute of all brightness and transparence, formed into thin plates, and usually found coating over the sides of fissures, and other cavities of stones, with congeries of them of great extent, and of plain or botroyide surfaces.

Of these there are usually reckoned seven kinds: the first is the hard, brownish-white cibdelostracium, found in Germany: the second is the hard, whitish cibdelostracium, with thin crusts, and a smother surface, found also in the Harts-forests in Germany: the third is the hard, pale-brown cibdelostracium, with numerous very thin crusts, found in subterranean caverns in many parts of England as well as Germany: the fourth is the white, light, and friable cibdelostracium, found also in Germany, but very rarely in any part of England: the fifth is the light, hard, pale-brown cibdelostracium, with a smooth furface, found in almost all parts of the world: the sixth is the whitish, friable crustaceous cibdelostracium, with a rougher surface, frequent in Germany and England; and the seventh is the brownish-white friable cibdelostracium, with a dusty surface, found in several parts of Ireland, as well as Germany.



CIBORIA, in antiquity, the large husk of Egyptian beans, which are said to have been so large as to serve for drinking cups; whence they had their name *ciborium*, signifying a cup, in the Egyptian language.

CIBORIUM, in eclesiastical writers, the covering for the altar. This covering is supported by four high columns, and forms a kind of tent for the eucharist, in the Romish churches. Some authors call it *turris gestatoria* and others *pyxis*; but the pyxis is properly the box in which the eucharist is preserved.

CIBUS FERIALIS, in antiquity, an entertainment peculiar to a funeral; for which purpose, beans, parsley, lettuce, bread, eggs, lentils, and salts were in use.

CICADA, the FROG-HOPPHER or FLEA-LOCUST, in zoology, a genus of insects belonging to the order of hemiptera. The beak is inflected; the antennæ are setaceous; the four wings are membranaceous and deflected: and the feet, in most of the species, are of the jumping kind. The species are fifty-one. The larvæ of several of this genus evacuate great quantities of a frothy matter upon the branches and leaves of plants, in the midst of which they constantly reside, probably for shelter against the search of other animals, to which it would become a prey. Nature has afforded this kind of defence to insects whose naked and soft bodies might otherwise very easily be injured; perhaps also the moisture of this foam may serve to screen it from the sultry beams of the sun. On removing the foam, you discover the larva concealed underneath; but it does not long remain uncovered. It soon emits fresh foam, that hides it from the eye of observation. It is in the midst of this foamy substance the larva goes through its metamorphosis into a chrysalis and perfect insect. Other larvæ, whose bodies are not so soft, run over plants without any manner of defence, and escape from insects that might hurt them, by the nimbleness of their running, but especially of their leaping. Plate CXLIX.

The chrysalids, and all the larvæ that produce them, differ little from each other, only that the former have the rudiments of wings, a kind of knob at the place where the wings will afterwards be in the perfect insect. As to other respects, the chrysalids walk, leap, and run over plants and trees; as do the larva and the frog hopper, which they are to produce. At length they through off their teguments of chrysalids, slip their last slough, and then the insect appears in its utmost state of perfection. The male alone is then endowed with the faculty of singing, which it exercises not with its throat, but with an organ situated under the abdomen. Behind the legs of the male are observed two valvulæ, which, raised up, discover several cavities, separated by various membranes. The middle contains a scaly triangle. Two vigorous muscles give motion to another membrane, which alternately becomes concave and convex. The air agitated by this membrane, is modified within the other cavities; and by the help of this sonorous instrument, he amorously solicits his female. By pulling the muscles of a frog-hopper lately dead, it may be made to sing. This insect begins its song early in the morning, and continues it during the heat of the noontide sun. Its lively and animated music is, to the

Cicada. country people, a presage of a fine summer, a plentiful harvest, and the sure return of spring. The cicadæ have a head almost triangular, an oblong body, their wings fastigiated or in form of a roof, and six legs with which they walk and leap pretty briskly. In the females at the extremity of the abdomen are seen two large laminæ, between which is inclosed, as in a sheath, a spine, or lamina, somewhat serrated, which serves them for the purpose of depositing their eggs, and probably to sink them into the substance of those plants which the young larvæ are to feed upon.

CICADA *septemdecim*, or Locust of North America, ranks with the cricket and grass-hopper, as one genus of insects belonging to the order of hemiptera, and has most of the distinguishing characteristics of the grass-hopper, though its legs do not appear formed for leaping, as it is observed the insect seldom removes without using its wings.—The characters of the Cicada, or American locust, are these: The beak is inflected; the antennæ are setaceous; the four wings are membranaceous, and deflected, and have much the appearance of the wings of some of the fly kind; the thorax is compressed and angulated, and the feet, in most of the species, are of the jumping kind.—A gentleman who observed it in Pennsylvania in 1782, gives the following account.

"This remarkable insect, though but trivial attention has been given to its history, appears as an extraordinary phenomenon in the works of creation. Its periodical visits—its long absence—the numbers which rise from the earth, where they have, perhaps, undergone various transformations, whilst they have lain, entombed, for the space of 15, 16, or even 17 years, (for they are not always regular in their visits) certainly deserve some enquiry.

"We know not the progress of the American locust, through its several changes during its long confinement in the earth. I have no doubt but it often alters its appearance, and though these changes remain, as yet, amongst the arcana of nature, yet some interesting observations may result from a pursuit of the enquiry, as far as their last appearance, which was in the year 1782, will admit of.

"Towards the latter end of May, under such trees as had been planted, previous to their former visit, the ground was perforated; so as, in some degree to resemble a honey-comb; and from these perforations, issued an army of these insects; which, if they had been endued with the voraciousness of the locusts of the east, must have spread devastation and terror throughout the country they fixed upon for a visit.—But happily the cicada or locust, in this state, is not more injurious than the sportive summer grass-hopper.

"The appearance of the locust, when first escaping from its earthy mansion, is a large amber-coloured grub-worm, about one inch and an half in length, and about an inch and half in circumference; the feet are more strongly formed than those of the grasshopper, and considerably shorter;—the insect seldom leaping, as has been before observed;—in the outer covering, *or grub-case, if the term may be admitted*, near the back of the neck, begins an opening, which continues down the body, nearly half the length of the insect: through this opening the locust protrudes itself, and appears, at first a white coloured moth, nearly resembling a silk-worm, in its moth state, though much larger. The wings in this tender state of the insect are wonderfully folded in close rolls near their basis, so exquisitely compact, that it required several careful observations, to comprehend the possibility of the wings being formed with the insect, as it really appeared an almost instantaneous creation, when they were expanded, which was performed by the locust shaking itself with a considerable force.

"When the insect relieves itself from the outer covering or grub-worm case, the wings are of the hue of rich milk. In this state, the filaments, which add strength to them, are of the same white colour, and instead of the transparency which they afterwards obtain, they are now remarkably opaque; but as soon as the moisture dries from off the wings of the insect, these filaments become more firm, and have a dark brown colour which approaches a black as the locust becomes stronger.

"The time when they issue from the ground, is about an hour or two after sun-set; soon after which they begin their exertions to free themselves from the grub case, which the stronger ones effect in an hour or two.—They remain on the branches of the trees, which they have attained, (before this last metamorphosis) until morning, when they are of an high amber colour—have acquired their strength, and are able to contend with some of their enemies. The weaker ones, and those who do not leave the earth till morning, do not so easily effect their transformation, and often prove a delicious prey to the larger and even the smaller birds.

"While in the grub-worm state, there is a fissure in the back of the skin, sufficiently large to admit the locust to pass therefrom, which, notwithstanding, is not done without great exertions. At the time of their leaving the grub-case, for it cannot be, with propriety, termed a chrysalis, life and motion is strong in the insect, even when it is about assuming its new form. And when we consider that every particular limb, every part of the body however delicately and tenderly formed,—and really some of them, at this time, are almost inconceivably thin and tender—is inclosed in a separate case, and that these tender parts must be necessarily extricated from their sheaths, before the insect can enjoy uninterrupted freedom, we certainly feel our astonishment increase, in observing, that those so elegantly formed members escape uninjured from even the extremities of their covering.—When this escape is effected, the insect leaves the place where its covering is, and rests at a very short distance from it, where it remains until the moisture is evaporated from its body. The wings, as well as the insects, when first protruded from the grubcase, are very moist and tender; though by degrees they dry, and become more firm and rigid. But should any accident prevent the cicada from a free expansion of its wings, for a considerable time after the grub-case is forsaken, the poor insect is doomed to remain either in a state of total or partial debility;—for should it be so weak as to be unable to expand its wings thoroughly, while the moisture and pliancy remain, as soon as they become dry and rigid, they are fixed in that particular or total want of expansion; and in this helpless state, the cicada is a certain prey even to the long-applauded industrious emmet.

 The

Cicada. "The locust-grub, rising from the ground, is nearly the colour of the locust when it has attained its full perfection, though not altogether as dark; its strength is very great, nearly equalling that of the scarabæus carnifex (or the beetle which forms the balls from ordure): But as it is about to leave the case, it becomes weaker.

"At the time of their last appearance, an apple-tree was approved of for the theatre of my enquiry; and though it must have been very small at the time of their former visit, yet, having carefully collected the grubs which came up under its branches, the first evening I numbered 500, which I removed; the second evening 600 more had made their appearance, and the third evening upwards of 400. Several stragglers remained, who were neglected, as the numbers were already sufficiently great to claim my whole attention.

"Two or three days after their assuming the moth state, the air resounded with their notes, which were re-echoed either on the wing, or on the branches of the trees indiscriminately. These notes, expressive as those of the feathered songsters, proved a call to courtship. The power of song, which somewhat resembled the noise of a stocking-loom, was confined to the male—which it was easy to discover was produced by inflating air into his body, and expressing it through two small apertures, placed a little below the base of his wings;—these holes lead from a musical table, on each side of which are five or six thin bars, connected by exquisitely fine membranes; which, during the time of song, maintain a continual vibration. Like the grasshopper, the locust very seldom sports its social call without a response from almost all the males within hearing; and frequently when the courtship has obtained his mate's approbation, an intruder allured by the concert, which is easily distinguished, challenges the hero to combat, and the fight is often long and desperate—as the victory always confers an interesting reward.*

"When gestation is fully accomplished, which is generally two or three days after they have assumed the flying state, the female prepares to deposit her burden; and although her body does not appear greatly distended, yet she generally lays about 140 eggs.—The egg is of a white colour, and about a line in length, and one-third of a line in diameter. Nature has wonderfully provided her with an instrument in her tail, somewhat resembling a two-edged sword, which, like the grasshopper, she can sheath and unsheath at pleasure: with this she perforates the tender twigs of such trees as will afford a convenient nidus for the eggs, and deposits them by 14 or 15, under the bark, in the form of the letter V; and sometimes she pierces thro' a twig one-fourth of an inch thick.—After she has carefully deposited her eggs in the smaller branches, a sudden blast of wind frequently lops the branch she has chosen for their residence.

"It is thus that the parent provides for a succession of the species, in which employment she is generally busied until about the tenth day of her moth state, seldom if ever feeding on any thing but the early dew: For, as they fly in such numbers, (and always carelessly, without a leader, as is usual with the eastern locusts) were they to feed on plants the damage must certainly be observable: and as they live in the moth state twelve or thirteen days, it is probable they have a portion of the dew of heaven for their sustenance. Then they dry up as the silk-worm moth,—the male becoming superannuated two or three days before the female.

"Having pursued the locust thro' its several moth stages, the numerous offspring it has deposited in the slender twigs of trees, have still some claim to an investigation.—The eggs are of a cylindrical form, rounded at the ends, and are of such a consistence, that they require a hard pressure between the fingers to crush them. The substance within, as in most other small eggs, is a white, transparent, and viscous fluid. In about the space of fourteen days, from the time of their first being left by the parent, the egg produces a whitish insect, somewhat larger than the silk-worm, when fresh hatched, which leaves the branch where the nest was, and, dropping on the ground, either enters into the hole through which the old locust issued, or turns the earth aside afresh, and entombs itself there, to undergo the metamorphosis of its ancestors.

"In digging wells, cellars, &c. in America, insects of very different appearances have been discovered, some twenty feet deep, which have been supposed to be of this species—others have been discovered nearer the surface, of which no doubt remains but that they are the grub of the locust—and early in the spring, previous to their assuming the moth state, the ploughshare often furnishes the blackbird, which follows the ploughman, with a rich repast of them; for which, by his clamours and flutterings, he endeavours to express his obligations. Varieties of this genus appear annually, they are in general much larger than the cicada septemdecim, and of a greyish cast; the dark brown or amber colour which the others have, appearing in these mottled with a dirty white." Cicada.

CICATRICULA, among natural historians, denotes a small whitish speck in the yolk of an egg, supposed to be the first rudiments of the future chick.

CICATRIX, in surgery, a little seam or elevation of callous flesh rising on the skin, and remaining there after the healing of a wound or ulcer. It is commonly called a *scar*.

CICATRIZANTS, in pharmacy, medicines which assist nature to form a cicatrix. Such are Armenian bole, powder of tutty, &c.

Cicatrizants are otherwise called *escharotics*, *epulotics*, *incarnatives*, *agglutinants*, &c.

CICCA, in botany; a genus of the tetrandria order, belonging to the monœcia class of plants. The male calyx is tetraphyllous; there is no corolla: the female calyx tryphyllous; no corolla; four styles; the capsule quadricoccous, or four berried.

CICELY,

* Mas et feminina Cicada in coitu [æquè ac Grylli species] adeo firmiter uniti, ut sine corporum mutilatione separari nullo modo possint; et in hoc statu per horas multas remanent, donec foecundationis opus perfectum sit. Per lucos firmiter sic uniti sæpe volitant, et complures simul in conspectu apparent.

CICELY, in botany, the English name of a ſpecies of chærophyllum. See CHÆROPHYLLUM.

CICER, or CHICK-PEA, in botany: A genus of the decandria order, belonging to the diadelphia claſs of plants; and in the natural method ranking under the *Papilionaceæ*, or 32d order. The calyx is quinquepartite, as long as the corolla, with its four uppermoſt ſegments incumbent on the vexillum: the legumen is rhomboidal, turgid, and diſpermous. There is but one ſpecies, which produces peaſe ſhaped like the common ones, but much ſmaller. They are much cultivated in Spain, where they are natives, being one of the ingredients in their olios: as alſo in France; but are rarely known in Britain.



END OF THE FOURTH VOLUME.

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